Kings Basin

Integrated Regional Water Management Plan

Adopted

October 17, 2018

KINGS BASIN

Water Authority

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The Kings Basin Integrated Regional Water Management Plan was adopted by the Kings Basin Water Authority on October 17, 2018:

Members	Interested Parties
Alta Irrigation District	Armona Community Services District
City of Clovis	Bakman Water Company
City of Dinuba	Biola Community Services District
City of Fresno	California Native Plant Society
City of Kerman	California State University, Fresno
City of Parlier	City of Kingsburg
City of Reedley	City of Orange Cove
City of Sanger	City of San Joaquin
City of Selma	Community Water Center
County of Fresno	County of Kings
County of Tulare	Crescent Canal Company
Consolidated Irrigation District	Cutler Public Utility District
Fresno Irrigation District	East Orosi Community Services District
Fresno Metropolitan Flood Control District	Easton Community Services District
Kings County Water District	El Rio Reyes Conservation Trust
Kings River Conservation District	Hardwick Water Company
Raisin City Water District	James Irrigation District
	Kings River Conservancy
	Kings River Water Association
	Laguna Irrigation District
	Lanare Community Services District
	Laton Community Services District
	Liberty Canal Company
	Liberty Water District
	London Community Services District
	Malaga County Water District
	Mid-Valley Water District
	Orosi Public Utility District
	Pinedale County Water District
	Reed Ditch Company
	Riverdale Irrigation District
	Riverdale Public Utility District
	Sanger Environmental Fund
	Self-Help Enterprises
	Sierra Club, Tehipite Chapter
	Sierra Resource Conservation District
	Sultana Community Services District
	Terranova Ranch, Inc.
	Tulare Basin Wildlife Partners
	University of California Cooperative Extension – Fresno County

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ABBREVIATIONS

AEWSD ..... Arvin Edison Water Storage District
AF ..... Acre-Feet
AID ..... Alta Irrigation District
ATSDR ..... Agency for Toxic Substances and Disease Registry
AWEP ..... Agricultural Water Enhancement Program
AWMC ..... Agricultural Water Management Council
AWMP ..... Agricultural Water Management Plan
BAP ..... Basin Advisory Panel
BMP ..... Best Management Practice
CASGEM ..... California State Groundwater Elevation Monitoring
CDC ..... Center for Disease Control
CDPH ..... California Department of Public Health
CEQA ..... California Environmental Quality Act
CFS ..... Cubic Feet per Second
CID ..... Consolidated Irrigation District
Corps ..... United States Army Corps of Engineers
CSA ..... County Service Areas
CSD ..... Community Services District
CVP ..... Central Valley Project
CVPIA ..... Central Valley Project Improvement Act
CV-SALTS ..... Central Valley Salinity Alternatives for Long-Term Sustainability
CWC ..... California Water Code
CWP ..... California Water Plan
DAC ..... Disadvantaged Community
DBCP ..... Dibromochloropropane
DFG ..... Department of Fish and Game
DMC ..... Delta Mendota Canal
DMM ..... Demand Management Measure
DMS ..... Data Management System
DPLA ..... Division of Planning and Local Assistance
DWR ..... Department of Water Resources
DWSAP ..... Drinking Water Source Assessment & Protection
EPA ..... Environmental Protection Agency
EWMP ..... Efficient Water Management Practice
FCMP ..... Flood Control Master Plan
FEMA ..... Federal Emergency Management Agency
FID ..... Fresno Irrigation District
FMFCD ..... Fresno Metropolitan Flood Control District
FWS ..... Fish and Wildlife Service
GHG ..... Greenhouse Gas
GIS ..... Geographic Information Systems
GS ..... Groundwater Sustainability Agency
GSP ..... Groundwater Sustainability Plan
GWMP ..... Groundwater Management Plan

ILRP ..... Integrated Lands Regulatory Program
IGSM ..... Integrated Groundwater Surface Water Model
IRWM ..... Integrated Regional Water Management
IRWMA ..... Integrated Regional Water Management Authority
IRWMG ..... Integrated Regional Water Management Group
IRWMP ..... Integrated Regional Water Management Plan
JID ..... James Irrigation District
JPA ..... Joint Powers Agreement
KBWA ..... Kings Basin Water Authority
KBWQA ..... Kaweah Basin Water Quality Association
KRCD ..... Kings River Conservation District
KRWA ..... Kings River Water Authority
KRWCA ..... Kings River Watershed Coalition Authority
KRWQC ..... Kings River Water Quality Coalition
LAFCO ..... Local Agency Formation Commission
LID ..... Low Impact Development
LGA ..... Local Groundwater Assistance
MCL ..... Maximum Contaminate Level
MHI ..... Median Household Income
MOU ..... Memorandum of Understanding
MSR ..... Municipal Service Review
MVWA ..... Mid-Valley Water Authority
NAWQA ..... National Water Quality Assessment
NCCSP ..... National Center for Conservation Science and Policy
NEPA ..... National Environmental Policy Act
NFG ..... North Fork Group
NOAA ..... National Oceanic and Atmospheric Administration
NGO ..... Nongovernmental Organizations
NRCS ..... Natural Resources Conservation Service
O&M ..... Operations and Management
PG&E ..... Pacific Gas & Electric
PPM ..... Parts Per Million
PUD ..... Public Utility District
RCD ..... Resource Conservation District
RMS ..... Regional Management Strategies
RWQCB ..... Regional Water Quality Control Board
SB ..... Senate Bill
SCE ..... Southern California Edison
SDMP ..... Storm Drain Management Plan
SGMA ..... Sustainable Groundwater Management Act
SKFCSD ..... Selma-Kingsburg-Fowler County Sanitation District
SLW ..... Supercooled Liquid Water
SSJVWQC ..... San Joaquin Valley Water Quality Coalition
SSMP ..... Sewer System Management Plan
SWMP ..... Stormwater Management Plan

SWP ..... State Water Project
SWRCB ..... State Water Resources Control Board
TDS ..... Total Dissolved Solids
THM ..... Trihalomethanes
TLB ..... Tulare Lake Basin
TMDL ..... Total Maximum Daily Load
TMF ..... Technical Managerial & Financial
USBR ..... United States Bureau of Reclamation
USDA ..... United States Department of Agriculture
USFWS ..... United States Fish and Wildlife Services
USGS ..... United States Geologic Survey
UWMP ..... Urban Water Management Plan
UWMPA ..... Urban Water Management Planning Act
VOC ..... Volatile Organic Compound
WWD ..... Water Works Districts
WWMP ..... Wastewater Management Plan

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EXECUTIVE SUMMARY

Introduction

The Kings Basin Integrated Regional Water Management Plan (IRWMP) is a collaborative effort between 57 public, private and non-governmental agencies to manage water resources in the Kings Groundwater region (Kings Basin). The Kings Basin is a sub-basin of the San Joaquin Valley groundwater basin, within the Tulare Lake Hydrologic Region. The IRWMP region includes nearly all of the Kings Sub-basin and small portions of the Delta-Mendota, Kaweah and Tulare Lake Sub-basins.

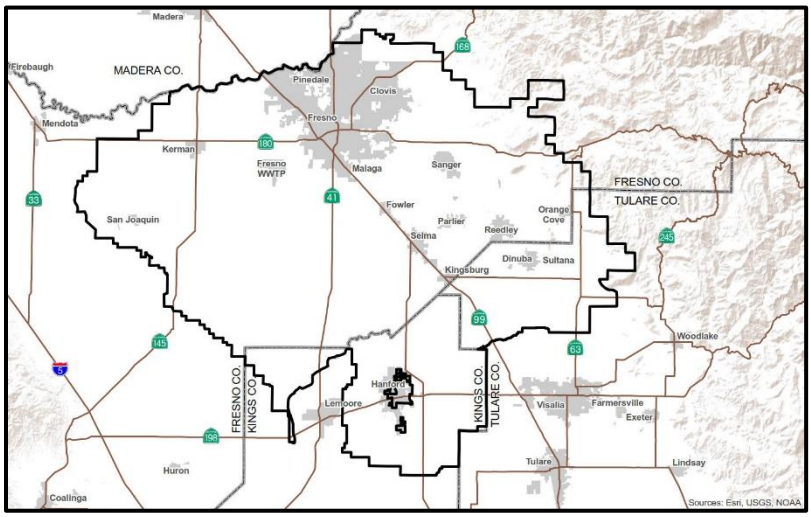
Historically, water management in the Kings Basin was limited to independent operations by local water agencies and individual water users. Local agencies initiated a process of regional cooperation in 2001, prepared an IRWMP in 2007, an updated to the original IRWMP in 2012 and again in 2018. This regional effort continued to grow and evolved into the formation of the Upper Kings Basin Integrated Water Management Authority (Kings Basin Water Authority or Authority) in 2009. In 2018, the Authority included 17 official members and 40 interested parties. The 2012 IRWMP was updated to comply with new IRWMP standards established by the Department of Water Resources (DWR), document changes in policies and procedure, describe updated approaches to water management, and include information on new stakeholders and their input on water management issues. The region and its IRWMP were accepted by DWR during the IRWMP Regional Acceptance Process of 2009.

> *"The vision of the Kings Basin Water Authority is a sustainable supply of the Kings River Basin's finite surface water and groundwater resources through regional planning that is balanced and beneficial for environmental stewardship, overall quality of life, a sustainable economy, and adequate resources for future generations."*

This updated IRWMP Planning horizon extends 20 years to the year 2038. By working with varied interests and needs, the IRWMP planning process has opened the doors to partnerships, funding opportunities, operational connectivity, and increased awareness of planning efforts and potential projects.

Region Description

The Kings Basin IRWMP covers over 1,123,000 acres and includes parts of Fresno, Kings and Tulare Counties. The IRWMP area also includes numerous cities, communities, water districts, irrigation districts, and special districts.



Map of Kings Basin IRWMP Area

The region uses both surface and groundwater to meet water needs. The Kings River is the major source of surface water. Operation of Pine Flat Reservoir provides a facility to regulate the Kings River flows and provides storage, flood control, hydropower and recreational benefits. The San Joaquin River defines the northern boundary of the IRWMP region and provides surface water to some areas in the northern portion of the Kings Basin.

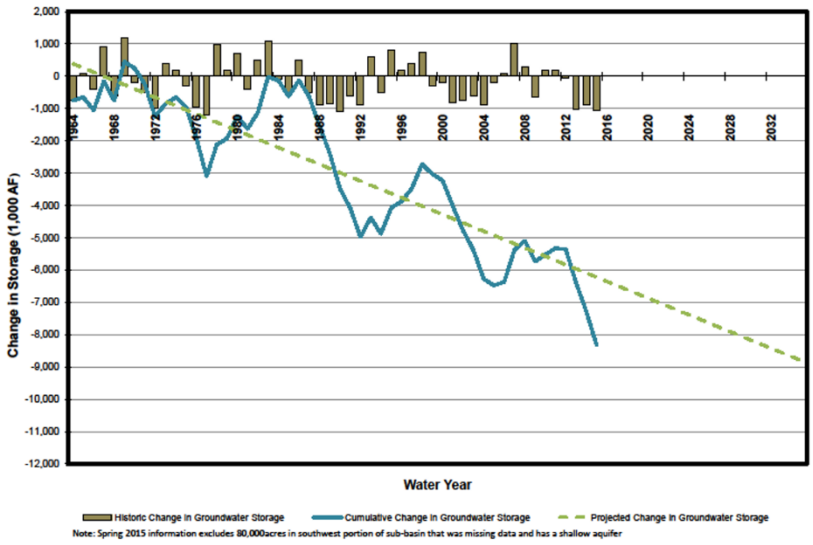
Much of the Kings Basin is developed for agriculture and wide varieties of crops are grown. Most crops require irrigation water during the dry season, and irrigated lands cover about 760,000 acres. An extensive network of canals is used to deliver water to agricultural lands and groundwater recharge facilities. The region is comprised of several major urban areas, including the Fresno- Clovis metropolitan area. The majority of the IRWMP area has been ecologically modified through urbanization and agriculture. The Kings River supplies the most prominent riparian and wetland habitat in the area and provides the main corridor for fish and wildlife movements.

Kings River

The IRWMP boundary is logical for regional management since the local agencies share the same groundwater basin, use the same surface water sources and the stakeholders face similar water management issues and concerns (Chapter 3).

Water Management Challenges

The region faces many water management challenges including groundwater overdraft, surface water shortages in dry years, and groundwater quality problems in certain areas. Groundwater overdraft is generally considered the largest regional problem; historically, the overdraft in the Kings Basin portion of the plan area had been estimated to be 100,000 to 150,000 AF/year over a 40-year average. More recently, shorter term estimates calculated as part of the Sustainable Groundwater Management Act (SGMA) required efforts indicate a higher amount of overdraft within the Kings Basin. The long-term decline in groundwater storage will be significant if current water management strategies are maintained. Correcting the overdraft through regional efforts will help lead to overall maintenance and improvement in the quantity, quality and cost of development of groundwater resources in the region.



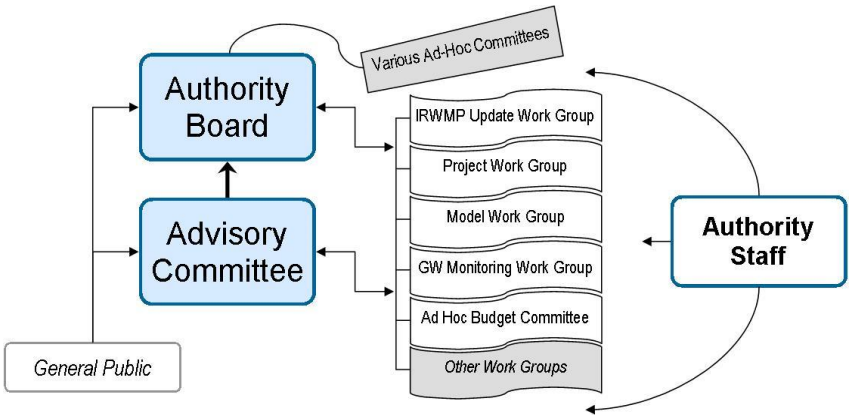
Historical and Projected Groundwater Level Decline

Within certain areas of the region and for certain stakeholders, water quality and water reliability are higher priorities than overdraft correction. Communities completely reliant on groundwater for drinking water purposes are experiencing an increasingly difficult time meeting drinking water standards. Improving and protecting water quality remains a significant challenge that can also benefit from regional and cooperative efforts.

The DWR established 16 IRWM Plan Standards that must be addressed in updated IRWMPs. These are addressed in separate chapters of the IRWMP and are summarized below:

Governance

The Authority is governed by a Joint Powers Agreement (JPA) made effective on March 1, 2009. The JPA formed a legal Authority that satisfies the definition of a Regional Water Management Group according to the California Water Code. Members must execute the JPA and pay an annual assessment. Interested parties can participate free of cost. The Authority is governed by a Board of Directors comprised of one representative from each Member agency. An Advisory Committee and numerous Work Groups provide advice to



Joint Power Authority Organization Chart

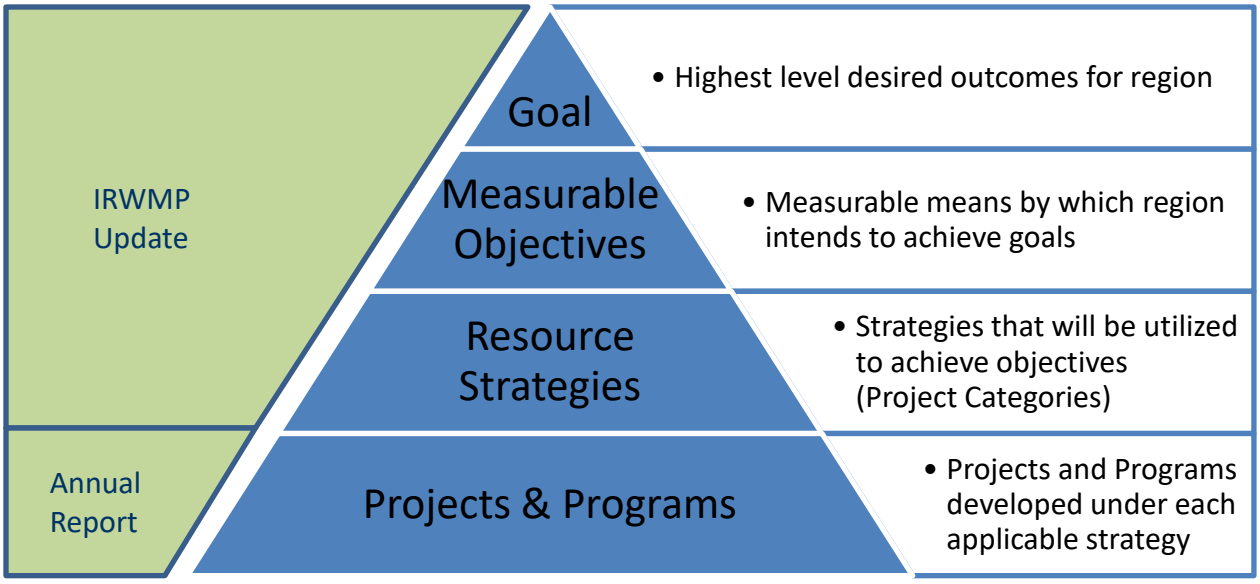
the Board of Directors and assist with IRWMP plan development, technical studies, project evaluation, and administrative efforts. The organizational structure provides balanced opportunities for stakeholder participation. (Chapter 2)

Disadvantaged Communities

A Disadvantaged Community (DAC) is a community with mean annual household income less than 80% of the statewide average. The Kings Basin includes approximately 90 unique DACs. Many of the DACs have critical water supply and water quality needs. Agriculture is a large sector of the economy in many DACs, and maintaining this economic base requires a reliable water supply. Water supplies are also needed to accommodate urban, commercial and industrial growth in DACs. A regional study on DAC water issues, completed in 2013, engaged DACs concerning their water, sewer, and storm drain issues, and developed potential projects to address their water supply problems. (Chapter 4)

Goals and Objectives

The Authority developed regional Goals and Objectives to provide focus to their planning efforts. These Goals and Objectives consolidate urban, agricultural and environmental concerns. Goals are the highest-level priorities, and objectives are more specific actions to meet the goals. The objectives can be accomplished through resource management strategies, projects and programs. The process to identify Goals and Objectives considered those developed in the 2007 IRWMP and updated in the 2012 IRWMP, the 2010 and 2016 IRWMP Guideline requirements, and changed conditions within the basin since the IRWMP was adopted. The regional goals include: 1) reduce groundwater overdraft; 2) increase water supply reliability; 3) improve water quality and drinking water reliability; 4) enhance flood protection; and 5) enhance ecosystems and the services they provide. Mitigating groundwater overdraft is generally considered the highest regional priority, but water quality and water reliability are higher priorities in some areas. Fifteen measurable objectives were identified to help meet the five goals. Each objective was assigned a metric so its progress can be measured. (Chapter 5)



Hierarchy of Goals, Objectives, Strategies and Programs

Resource Management Strategies

A resource management strategy is a category for a type of project, program, or policy that helps local agencies manage their water and related resources. This IRWMP evaluates 31 strategies listed in the 2013 California Water Plan Update, and 'Drought Planning', a strategy added by the Authority. The evaluations include a description of each strategy, current use and applicability in the Kings Basin, and constraints to development. The Kings Basin actively uses 28 Resource Management Strategies and therefore maintains a diverse and comprehensive water management portfolio. High priority strategies include urban and agricultural water use efficiency, conjunctive use, recycled municipal water, and urban runoff management. (Chapter 6)

Project Review Process

The Authority has a project review process to identify and rank potential projects for funding or inclusion in grant applications. The Authority calls for project submittals once a year to include in a regional list, but stakeholders can submit project descriptions at any time. The project description is reviewed for completeness and conformance to IRWMP objectives and goals. If a project meets those requirements, it is added to the list and then documented in an annual report. The list is prepared to help prevent duplication, foster project integration, and encourage stakeholders to be prepared for grant solicitations. When funding opportunities arise the Authority notifies stakeholders. A Project Selection Panel (Panel) is formed to review potential projects. Stakeholders are invited to submit more detailed project information, and the projects are prioritized by the Panel. The Panel identifies the most promising projects for inclusion in grant applications. The recommended list then requires approval from the Advisory Committee and Board of Directors. (Chapter 7)

Impacts and Benefits of Plan Implementation

Historically, local water management, especially groundwater, was limited to independent operations by each overlying water agency. Regional water management planning enhances the local, fragmented approach with a more comprehensive and cooperative methodology. Some problems, such as groundwater overdraft, can only be solved with regional cooperation. A comprehensive list of benefits and impacts from implementing the IRWMP were identified for the Kings Basin and surrounding IRWMP regions. The impact/benefit analysis can be used to prioritize goals, prioritize resource management strategies, set benchmarks for evaluating IRWMP performance, and identify potentially adverse impacts from implementation projects that are often overlooked. A benefit of the Plan's implementation is in measuring against a baseline for water supply and water quality to reconcile and measure regional project benefits with such baseline criteria over time. (Chapter 8)

Groundwater Recharge Basin in City of Clovis

Plan Performance and Monitoring

Stakeholders in the Kings Basin participate in various independent but related regional efforts to monitor surface water quality, groundwater levels, surface water flows, Kings River levees, and Kings River Fisheries. The Authority will prepare an Annual Report to document monitoring data and serve as a status report for the stakeholders, Board of Directors and the State. The report will summarize regional monitoring efforts, and document success in meeting IRWMP objectives, success in implementing projects, an updated project list, proposed amendments to the IRWMP, and changes in governance, policies, and membership. (Chapter 9)

Data Management

The Authority has developed data management procedures to ensure the efficient use of existing data and accessibility to stakeholders. Existing data management includes groundwater levels by the Kings River Conservation District (KRCD), surface water flows by the Kings River Water Association (KRWA) and Friant Water Authority (FWA), and

water quality by the Southern San Joaquin Water Quality Coalition via the Southern San Joaquin MPEP Committee. The Authority also maintains data on proposed projects in a database. The Authority previously developed a Data Management System (DMS) that it is not currently utilizing in anticipation of employing DWR's DMS once available. (Chapter 10)

Financing

The Authority requires funding for operations, IRWMP updates, regional technical studies, grant applications, and project implementation. The Authority's administrative and governance operations are funded by an annual dues payment by each member, thus ensuring on-going funds to keep the Authority operating. Numerous stakeholders also contribute by offering the use of facilities and volunteering time to operations and committees. Infrastructure projects are typically funded with project proponent funds and augmented with State or Federal grants and loans. The Authority tracks funding opportunities and shares the information with stakeholders. (Chapter 11)

Technical Analysis

The Authority prepared numerous studies to support the 2007 IRWMP. Topics covered include regional water supplies, water demands, hydrogeologic conditions, land use, and water quality. As a result, only a limited amount of new analysis was needed to update this IRWMP. The Kings Basin Integrated Groundwater and Surface Water Model (Kings IGSM or Model) is a regional model that simulates surface water and groundwater systems in the entire Kings Basin. The model was developed in 2007 and remains the primary analytical tool available to the Kings Basin. Prior model runs concluded that under current water management conditions groundwater levels will continue to decline. A simpler technique using a trendline was used to estimate future overdraft. Each year the Authority will compare the projected versus actual change in groundwater storage to monitor progress and refine long-term goals. (Chapter 12)

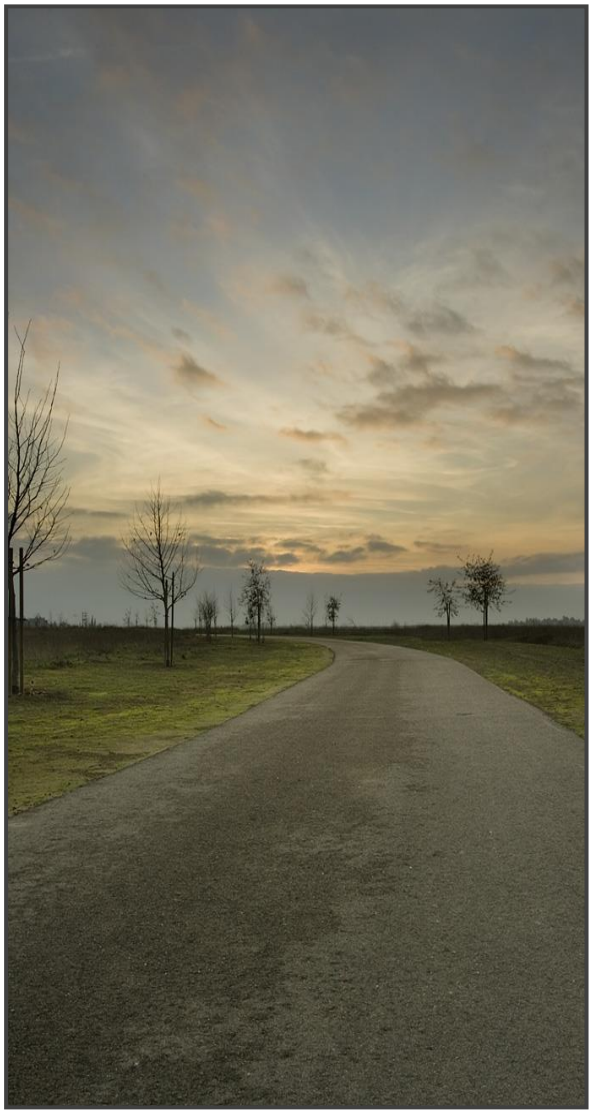
Relation to Local Water Planning

Local agencies have their own water planning documents that reflect their policies and goals. Local water plans include Urban Water Management Plans, Groundwater Management Plans, Water, Wastewater and Stormwater Master Plans, Water Conservation Plans, Agricultural Water Management Plans, and General Plans. Water plans from the Member and Interested Party agencies were reviewed and sections of the IRWMP were updated based on information, issues, and potential solutions provided in the plans. The local planning documents are often a reflection of the goals, objectives, and strategies of the IRWMP. The Authority is comprised of many local leaders, city council members, county supervisors and water agency directors, which serve as a link between the IRWMP and local water planning efforts. Additionally, the Authority

undertook the preparation of a Storm Water Resources Management Plan in 2018 which encompasses a majority of the boundary. The Authority believes that regional efforts lead to more effective and better-informed local efforts. Regional planning can serve as a basemap or guideline for the entire region to follow in local water resources planning. (Chapter 13)

Relation to Local Land-use Planning

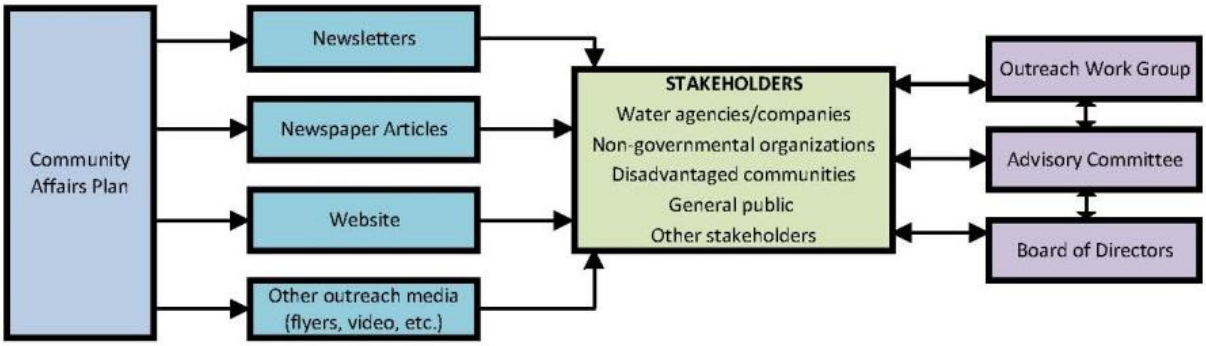
Local cities and counties manage land use according to General Plans and Municipal Service reviews. These documents were reviewed for consistency with the IRWMP and to incorporate local planning elements. The IRWM process provides many opportunities to collaborate and integrate with local land planners both at the city and county levels. Many general plans discuss integrated land use and water supply planning. However, many land use documents provide few, if any, details on regional overdraft, groundwater management, new water supply development, and impact on irrigation facilities. The land-use planning documents also have few details on how they plan to reach their water management goals. Several key approaches were identified to strengthen cooperation and communication with land-use planners. (Chapter 14)



Local Trail Area

Stakeholder Involvement

The Authority includes a diverse group of members and interested parties, which is the result of on-going public outreach efforts since 2004. Outreach efforts are led by an Outreach Work Group and follow a Community Affairs Plan, which is a living document and remains the backbone of the public outreach effort. Outreach methods include the Authority website, newspaper articles, newsletters, e-mails, printed materials, speaker's bureau, Advisory Committee, Work Groups, and Board of Directors meetings. Stakeholder involvement is considered fundamental to the success of the IRWMP, and outreach efforts will continue to educate current participants and seek new members and interested parties. (Chapter 15)



Stakeholder Involvement Process

Coordination and Integration

Coordination involves public outreach and facilitation efforts to bring stakeholders together and working as a unified group. Integration is defined as combining separate pieces into an efficient unified effort. These two IRWMP standards are closely related. The Authority's governance structure fosters integration and coordination through the organizational structure, opportunities for participation, and a public outreach program. The Authority has an integrated process to solicit and review projects and promotes multi-agency efforts. Data management is integrated through regional monitoring efforts, an annual Kings Basin report, and a regional hydrologic model. The Kings Basin also communicates regularly with neighboring IRWMP groups and State DWR staff. (Chapter 16)

Pine Flat Reservoir during Low Water Levels

Climate Change

Climate change in the Kings Basin could impact precipitation patterns and cause higher temperatures and earlier snowmelt. The area is especially vulnerable due to its dependence on mountain snow as a water supply. The IRWMP includes a climate change vulnerability assessment for water supplies, water demands, water quality, flooding, ecosystems, and hydropower. Climate change adaptation will be accomplished through 'no-regret' strategies, which are actions that have benefits with or without climate change. The main strategies will include water conservation, recycled water use, groundwater recharge, and increasing water storage capacity. (Chapter 17)

Kings Basin Water Authority

The Authority is an open organization and encourages participation from local water agencies, land-use agencies, industry organizations, non-governmental organizations, and individuals in the Kings Basin. The Authority's Advisory Committee meets every three months at the office of the Fresno County Farm Bureau.

Please contact Soua Lee (KRCD) at 559-237-5567 or visit their website at www.kingsbasinauthority.org if you have any questions about the IRWMP or Authority or would like to become a member or interested party.

Funding for updating the Kings Basin Water Authority IRWMP was in part provided by the California Department of Water Resources through a Proposition 1 IRWM Planning Grant.

Prepared by:

1 INTRODUCTION

The Kings Basin Water Authority Integrated Regional Water Management Plan (IRWMP) was developed to improve coordination and collaboration on regional water management in the Kings Basin. IRWMPs are prepared by regional water management groups comprised of a collection of agencies, stakeholders and individuals who share a common interest in managing water resources in a specific hydrologic region. The IRWMP for the Kings Basin Water Authority (Authority) was originally prepared in 2007, updated in 2012 to satisfy new State standards for IRWMPs and subsequently further updated in 2018 to satisfy evolving requirements.

1.1 Background

The Kings Groundwater region (Kings Basin) is located in the southern part of the San Joaquin Valley groundwater basin in the Central Valley of California. It is primarily an agricultural area, which uses both surface water and groundwater for irrigation purposes. The two primary sources of surface water for the Kings Basin are:

- Kings River; and
- San Joaquin River via Friant-Kern Canal, a component of the Friant Division of the federal Central Valley Project (CVP).

These two surface water sources are not sufficient to meet the water demand in the Kings Basin alone. Therefore, the water agencies in the area have been managing the available supplies through conjunctive use, which is the combined use of surface water and groundwater supplies and storage.

Due to insufficient surface water supplies, the Kings Basin has been operating under overdraft conditions for many years, with a historic annual overdraft of approximately 100,000 to 150,000 acre-feet (WRIME, 2003) calculated over 40 plus years of data; however, more recent estimates required under SGMA an increased amount of overdraft per year. Overdraft means that, on an average basis, more water is removed from the groundwater basin than is replaced, resulting in significant declines in groundwater levels throughout the basin. According to Bulletin 118 (DWR, 2003), the groundwater in storage in Kings Basin was about 93 million acre-feet (AF) in 1961; this estimate of storage was to a depth of 1,000 feet or less. It is also estimated that about 6 million AF of groundwater was mined from the Kings Basin during the past 50 years (See **Figure 12-1**).

The continued groundwater overdraft and the urban growth pressure in the region call for improved water resources management. Historically, the management of the water resources has been limited to independent operations by overlying local water agencies and individual water users. It is recognized that piecemeal planning constrains the potential for a solution to the region's most pressing issues and increases the potential for competition and conflict over the available water supplies.

As a result, the local agencies initiated a process of regional cooperation in 2001 to address the overdraft problem and develop implementable solutions. Kings River Conservation District (KRCD), Alta Irrigation District (AID), Consolidated Irrigation District (CID), and Fresno Irrigation District (FID) formed a Basin Advisory Panel (BAP), sought technical, facilitation, and financial support from the California Department of Water Resources (DWR), and signed a Memorandum of Understanding (MOU) that defined how they would work together to manage existing supplies and develop new supplies for the Kings Region.

The BAP made significant progress by working together to define the water resources problems but realized that the involvement of other stakeholders in the basin would be necessary if regional solutions were to be developed. As a result of these early efforts, the water districts solicited wider stakeholder participation and the Upper Kings Water Forum (Water Forum) was formed in 2004 to coordinate water resources planning in the Kings Basin. The Water Forum embarked on developing an IRWMP for the region to improve water management, reduce conflicts, protect water quality, and ensure sustainable resources management through regional cooperation. The IRWMP was completed in 2007.

In 2009, the Water Forum evolved into the Authority, a more formal organization governed by a Joint Powers Agreement (JPA). The Authority attracted several additional agencies in the lower Kings Basin, and, therefore, it now represents most of the water agencies in the Kings Basin. As a result, the Authority goes by the informal name of Kings Basin Water Authority. In 2018, the Authority included 17 official members and 40 interested parties.

The area covered by this IRWMP is shown on **Figure 1-1** and spans over parts of three counties: Fresno, Kings, and Tulare. The boundary roughly follows the border of the DWR defined Kings Groundwater Sub-basin. The IRWMP planning process included city and county governments, non-governmental organizations and other stakeholders. This diverse range of perspectives has been valuable in developing a consensus and selecting water management strategies for inclusion in the IRWMP that have a broad array of support.

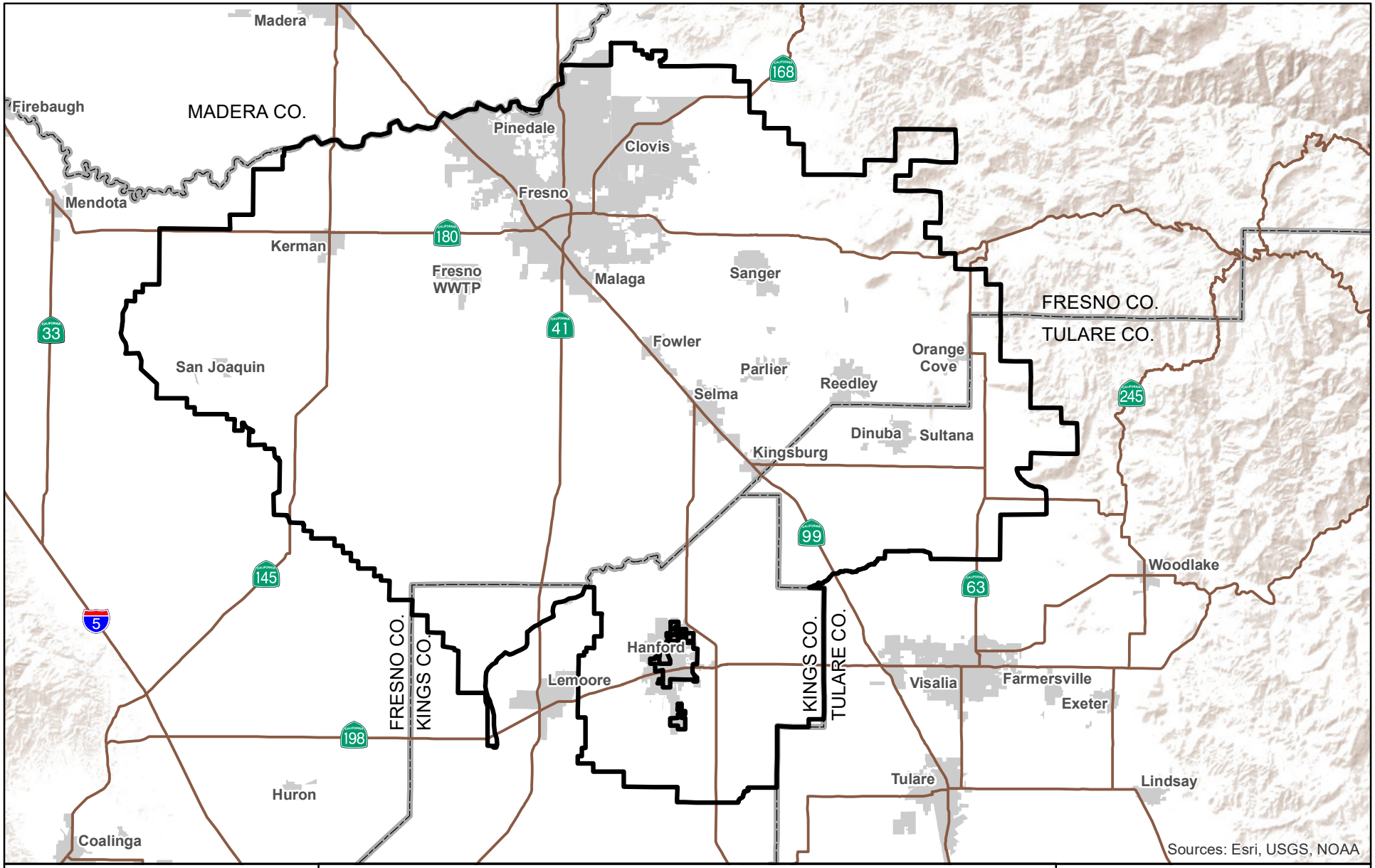


FIGURE 1-1

Kings Basin IRWMP

Regional Map

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1.2 Vision for the IRWMP

In 2006, the Authority adopted a 'vision statement' to ensure a common view of the future among all members. This vision set the direction of the Kings Basin IRWMP and guided the collaborative planning and decision-making process. The IRWMP defines issues, guiding principles, regional goals, objectives, strategies, actions, and projects to enhance the beneficial uses of water for the Kings Basin and ensure the sustainability of the water supply.

> **"The vision of the Kings Basin Water Authority is a sustainable supply of the Kings River Basin's finite surface water and groundwater resources through regional planning that is balanced and beneficial for environmental stewardship, overall quality of life, a sustainable economy, and adequate resources for future generations."**
>
> **Adopted in February 2006**

The Authority has taken the initiative to bring together the different interests in the Kings Region to better communicate, collaborate, and cooperate in solving regional issues that are beyond the capacity of any one entity to address. The Authority has recognized that all the stakeholders in the region, whether public agencies or non-governmental organizations, have unique perspectives and that all the individual interests need to be recognized if the IRWMP is to be successful.

Participating entities must continue to recognize and support the concept that regional integration will enhance their ability to manage their operations and collective resources, will increase their water supply reliability, and will provide a framework to improve water management across the region. More importantly, all participating entities should be assured that by participating in an IRWM program, they will not lose opportunities to control their own future, nor will they lose their autonomy. Regional integration does not seek to diminish the individual purveyor's decision-making power or a local government's power to exercise its rights. Instead, it seeks to enhance the collective power of the local entities and the ability to manage their resources. Participating entities would also be able to address water management issues on a much larger scale through an integrated planning framework.

By working with varied interests and agendas, the IRWMP planning process has opened the doors for partnerships, funding opportunities, operational connectivity, and increased awareness of planning efforts, projects and opportunities. In developing regional plans and prioritizing multi-benefit projects, it is important not only to coordinate efforts with other planning agencies within the region, but also to coordinate across regional boundaries. The Authority is working towards building bridges with surrounding regional efforts.

Since 2001, the Authority has leveraged over $35 million in financial support for use toward planning activities and to construct projects that address groundwater, water conservation and efficiency, water quality, riparian habitat, flood corridors, and critical

water supply and water quality needs of disadvantaged communities (DACs) throughout the basin.

The Authority has brought together a significant amount of information, communication concerning complex and controversial issues, and has developed a plan to address water supply and water quality issues in the Basin. Not all these issues are going to be fully addressed in this IRWMP, but the Authority and the integrated planning framework are expected to provide an on-going mechanism for resolving conflicts and within which water agencies, regulators, and environmental groups and other stakeholders can talk, identify common problems and concerns, and work together to find solutions. The Authority is prepared to address the continuing challenges related to coordinating groups with widely differing missions, agendas, and interests. Implementation of the IRWMP cannot succeed without continuous review and modification to meet new and unanticipated challenges.

1.3 Purpose, Need and Common Understanding for the IRWMP

Historically, water management in the Kings Basin has been limited to independent operations by overlying local water agencies and individual water users. This situation began to improve with the development of the BAP, and the region now has an effective regional water management group in the form of the Authority. The regional water management group was formed by the local land and water agencies and stakeholders to improve communication, collaboration, and cooperation; to develop a consensus on the regional problems and solutions; and to resolve or avoid conflicts. A general consensus has been achieved concerning the purpose of the Kings Basin IRWMP, which includes:

- Document how the Authority worked together through a collaborative process to identify issues, goals, and objectives for water resources management in the Kings Basin;
- Improve water management, reduce conflicts, protect water quality, and ensure sustainable resources management through regional cooperation;
- Identify and define different water management scenarios for the Kings Basin, evaluate alternatives to determine the most economical projects and programs to manage, and develop the surface and groundwater supplies in a sustainable manner;
- Prioritize immediate, near-term, mid-term, and long-term investments and define engineering solutions, program priorities, and institutional approaches to implement the IRWMP; and
- Provide a roadmap to work together within the Kings Basin and surrounding regions to further develop and manage the available water supplies and address water quality issues.

The need and value of the IRWMP is clear. The continued groundwater overdraft is not sustainable and the urban growth in the region, coupled with the need to sustain the agricultural economy, call for improved water resources management in the Kings Basin.

In 2006, the Authority drafted 'Agreements in Principle', which were then reviewed and adopted by the elected bodies representing the Authority throughout the winter of 2006–07. The Agreements in Principle contained a statement of common understanding that expresses the need for the Kings Basin IRWMP. The Agreements in Principle include:

- The [Authority] participants represent public agencies and community organizations that overlie the Upper Kings Basin and share a common groundwater resource. Any action affecting groundwater within any of the overlying land-use or water-district jurisdictions could impact that area and also have effects (positive or negative) throughout the basin.
- Overdraft of the Kings Groundwater Basin is a common problem for the cities, counties, and water districts in the region. If allowed to continue, it could threaten the region's economic prosperity and could reduce agricultural productivity as well as urban growth and development. This problem cannot be solved by any individual entity or jurisdiction; it is a regional problem that requires a regional solution.
- Solutions conceived in a vacuum to serve a limited area of interest or impact cannot adequately address regional water resource problems related to overdraft, water supply reliability, water quality, flood control, or ecosystems management.
- Groundwater overdraft has the potential to result in conflicts between geographic areas and different water use sectors in the basin. Local control and management must be demonstrated, and if the area does not take the initiative to develop [their own solutions via the] IRWMP, it is possible that [less workable or even the wrong] solutions could be imposed by the courts or the State.
- [Additional supply,] conjunctive use and groundwater management projects are needed to halt and reduce overdraft, avoid conflicts over the available groundwater supplies, and meet the IRWMP Goals and Objectives.
- [Additional supply,] conjunctive use and groundwater management is the integrating theme for the IRWMP. The planning framework has been designed to integrate water quality, ecosystem, flood control, and land use/recreation management strategies within this prevailing theme.
- The IRWMP will recognize, preserve and protect Kings River water rights. [The Kings Basin is hydrologically and hydraulically interconnected and is a resource shared by all individuals and organizations that overlie this common pool of resource. The activities of one organization have an effect on the activities of the other organizations.]

1.4 IRWMP Development

The initial IRWMP, prepared in 2007, was the outcome of a two-year collaborative planning and facilitated process that included completion of a wide range of technical studies, preparation of briefings and technical memorandums, development of the Kings Basin Integrated Groundwater and Surface Water Model (Kings IGSM), extensive stakeholder involvement and community affairs process, and numerous meetings among various work groups and participants. The local funding for these efforts was

supplemented by a Proposition 50 Planning Grant and other technical assistance grants from the DWR.

The IRWMP was updated in 2012 to comply with new IRWMP standards, and update information pertaining to governance structure and document changes in policies, procedures and members.

The IRWMP was updated again in 2018 for the following reasons:

- Comply with new IRWMP standards (DWR, 2016)
- Include information on the new governance structure
- Document changes in policies and procedures
- Include information on new members and interested parties that have joined since 2012, as well as their input on regional water management issues

The IRWMP update was led by an IRWMP Update Work Group, comprised of approximately ten volunteers from the members and interested parties. Each chapter was individually discussed through an open and transparent process. The IRWMP follows the required standards documented in '*Proposition 84 & Proposition 1E Integrated Regional Water Management Guidelines'* (DWR, 2010) and the *IRWM Planning Standards* (DWR, 2016). Funding for the IRWMP update was provided by a Proposition 1 IRWMP Planning Grant and in-kind support from the above stated volunteers.

1.5 Planning Horizon

The IRWMP planning horizon extends 20 years into the future. This is consistent with the standard 20-year planning horizon for IRWMPs. Some components of the plan extend further than twenty years, such as long-term predictions for groundwater overdraft and climate change.

1.6 Organization of the Report

This report is organized according to the sixteen IRWM Plan Standards listed by DWR (2010 and 2016). A chapter is dedicated to each standard with an additional chapter on DACs. A brief description of each chapter follows.

Table 1-1: Organization of the Report

Chapter	Subject	Description
1	Introduction	Provides background information on the Kings Basin, explains the Authority's vision for the Kings Basin IRWMP, its purpose and need, and the organizational structure of the IRWMP.
2	Governance	Describes the history of the regional water management group, the existing governance structure including the JPA, board of directors, committees, work groups, and decision-making protocols, and the role of governance in implementing the IRWMP.
3	Region Description	Describes members and interested parties, local hydrology, geology, and physiography of the Kings Basin, the basis for the IRWMP boundary, and the local water infrastructure.
4	Disadvantaged Communities	Describes the geography, demographics, economic conditions, and water resources problems in DACs in the Kings Basin.
5	Goals and Objectives	Describes the Authority's process for identifying and prioritizing issues to be addressed in the IRWMP, and the Goals and Objectives that were established to resolve the identified issues.
6	Resource Management Strategies	Presents 31 different Resource Management Strategies (RMS) that the Authority considered and describes their applicability and use in the Kings Basin.
7	Project Review Process	Describes the process used to solicit and review projects for possible funding or inclusion in grant applications
8	Impacts and Benefits of Plan Implementation	Discusses the general benefits of regional water management, impacts and benefits of RMS, impacts and benefits to neighboring IRWMPs, DACs, and interested parties, and evaluating impacts and benefits for specific projects.
9	Plan Performance and Monitoring	Describes several regional monitoring plans, describes the Authority's plan to monitor progress in meeting IRWMP Goals and implementing projects, reporting procedures and responsibilities, guidelines for project-specific monitoring, and the content of the Annual IRWMP report.
10	Data Management	Describes the Authority's existing and future plans for data collection, storage, and dissemination.

Chapter	Subject	Description
11	Financing	Provides a general overview of existing and potential funding sources for Authority operations, IRWMP updates, regional studies, grant application preparation, project implementation, and project operation and maintenance.
12	Technical Analysis	Describes the capabilities of the region's custom hydrologic model and provides a new long-term estimate for groundwater overdraft.
13	Relation to Local Water Planning	Describes local water plans prepared by cities, irrigation districts, and other special districts, and their compatibility with the IRWMP.
14	Relation to Local Land-use Planning	Describes local land-use plans and their goals related to water management, the compatibility of the water management goals with the IRWMP, and possible future collaborations with land-use planners.
15	Stakeholder Involvement	Discusses the public outreach effort during the IRWMP update, and a plan for future public outreach.
16	Coordination and Integration	Discusses the Authority's efforts to coordinate projects and activities with local agencies, stakeholders, neighboring IRWMPs, state agencies, and federal agencies.
17	Climate Change	Includes predicted impacts to the region from climate change, a vulnerability assessment for the Kings Basin, proposed adaptation measures, plan for monitoring climate change, and a process for evaluating greenhouse gas emissions in project selection.
18	References	Lists the documents cited in the Kings Basin IRWMP.

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2 GOVERNANCE

This section discusses the governance structure for the Regional Water Management Group including their Joint Powers Agreement (JPA), communication protocols and decision-making policies. Some governance topics are not specifically discussed in the JPA or other official governance documents but are incorporated in this IRWMP by reference to the separate policy documents.

2.1 Regional Water Management Group

The Regional Water Management Group is governed by a JPA that was made effective on March 1, 2009. The JPA formed a legal Authority called the Upper Kings Basin Integrated Regional Water Management Authority (Kings Basin Water Authority or Authority). The Authority satisfies the definition of a Regional Water Management Group provided in the California Water Code §10539 since it includes: 1) more than three local agencies; 2) at least two local agencies that have statutory authority over water supplies or water management; and 3) members that participate by means of a written agreement (JPA) that was approved by the governing bodies of the local agencies.

In 2012, the Authority is comprised of 17 official members and 40 interested parties, who are documented in Exhibits A and B of the JPA agreement. Those members and interested parties are shown on **Table 3-1** and **Figure 3-2**, and a description of each organization is provided in **Appendix A**. An organization chart for the Authority is shown below as **Figure 2.1**.

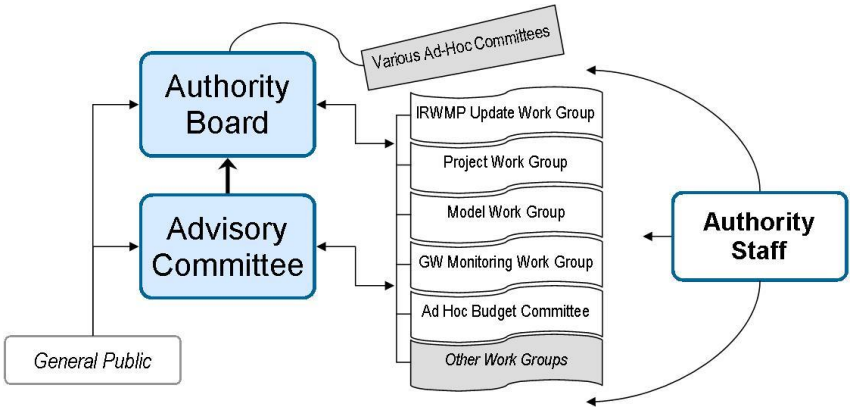


Figure 2.1 – Kings Basin Water Authority Organization Chart

Members must execute the JPA and pay an annual assessment set by the Board. All of the Members are public agencies with local water management authority. Interested Parties are those public and private entities that have opted not to become a member or are legally precluded from becoming a member, have provided a formal expression of interest in the Authority's activities, and been designated as an Interested Party by the Board of Directors. Interested parties can participate free of cost. Refer to **Table 3-2** for

information on which interested parties have water management authority. New entities wishing to join the Kings Basin Water Authority as either Members or Interested Parties must complete a three-step process, as outlined in Requirements for Applicants to Join the UKBIRMWA (Policy No. UKB-005), including submitting a written request to join, complete the Member/Interested Party questionnaire, and provide documentation of IRWMP adoption or intent to adopt.

The Members and Interested Parties represent a diverse range of interests. These include cities, counties, water districts, irrigation districts, community service districts, public utility districts, regional water management agencies, flood control agencies, canal companies, private water companies, private farming companies, and non-governmental organizations. This group is sufficient in breadth and participation to develop and implement the Integrated Regional Water Management Plan (IRWMP).

The Kings River Conservation District (KRCD) has taken a leading role in facilitating the efforts of the Authority. KRCD's role is logical since they are established as a regional water management agency, their jurisdiction encompasses the entire area covered by the IRWMP, and they have an agreement with the Authority to act as their Fiscal and Administrative Agent. KRCD was created by the state legislature pursuant to the Kings River Conservation District Act and has regional authority and responsibilities consistent with the IRWMP goals for groundwater management, flood control, water quality preservation, environmental stewardship, and public information. Certain members of KRCD staff serve as staff to the Authority for Authority business.

2.2 IRWMP Adoption

Public Notice Requirements and Plan Adoption

The IRWMP was updated and adopted through a formal public noticing procedure according to California Government Code §6066. This included notices in a local newspaper declaring 'an intent to update the IRWMP', and 'an intent to adopt the updated IRWMP'. This procedure is documented in more detail in Chapter 15 – Stakeholder Involvement.

Plan Adoption

The Plan was formally adopted by the Authority. **Appendix B** includes a copy of the resolution from the Authority adopting the plan. Member agencies and interested parties are required to adopt this IRWMP through separate action by their local governance structure and provide the Authority with proof of adoption.

History of Regional Water Management Group

The Authority initially began in 2001 as a group called the Basin Advisory Panel (BAP). The BAP included the KRCD and three local irrigation districts. This group sought technical, facilitation, and financial support from the California Department of Water

Resources (DWR) and was organized under a Memorandum of Understanding (MOU). The BAP enjoyed success on several regional projects, and, as a result, attracted several more members to join their group. The BAP eventually evolved into the Upper Kings Basin Water Forum (Water Forum) in 2004. The Water Forum prepared the initial IRWMP for the region in 2007. The Authority was formed in 2009 to replace the Water Forum.

Joint Powers Agreement

A JPA (**Appendix C**) was made effective on March 1, 2009 and formed the Upper Kings Basin Integrated Regional Water Management Authority. The entity's legal name became the Upper Kings Basin Integrated Regional Water Management Authority. Following expansion of the IRWMP boundary to include much of the lower Kings Basin, the Board took action and adopted the common or brand name Kings Basin Water Authority (Authority) as a shorter and more descriptively accurate name for the entity.

The JPA was developed with input from members and interested parties. In developing the JPA, the Authority also reviewed several JPAs developed by other regional water management agencies in California for ideas on content and governance procedures.

The Authority is governed by a Board of Directors comprised of one representative for each Member agency. At a minimum, Member agencies are required to designate at least one primary representative and one alternate. Primary representatives are typically elected officials. Each Board member has one vote. Interested parties do not need to execute the JPA but are governed by its provisions. Interested parties are non-voting but have an opportunity to provide direct input into nearly all Authority activities through committee and work group participation. Committees and Work Groups are described in Section 2.3.

Some of the powers of the Authority, documented in Section 2.04 of the JPA, are listed below:

- Coordinate activities to modify and implement the IRWMP
- Select projects for grant applications
- Prepare and submit grant applications
- Assist members in developing water projects
- Manage grant funding
- Create committees
- Enter into contracts and agreements
- Enter into litigation
- Engage consultants and employees
- Acquire and manage property
- Acquire by eminent domain
- Issue bonds and incur debt

2.3 Committees and Work Groups

An Advisory Committee and numerous Work Groups were formed to assist the Board of Directors with IRWMP development, technical studies, project evaluation, and administrative efforts. A brief description of the Advisory Committee and each Work Group is provided below.

Advisory Committee

The Advisory Committee (Committee) is the advisory body of the Authority and reports directly to the Board of Directors. The Committee is the only standing committee defined by the JPA and includes one representative from each Member and Interested Party. Each Member and Interested Party has one vote on the Committee. The Committee provides advice to the Board but has no authority to take action that binds the Authority. Advisory Committee Meetings are open to the public and any individual is welcome to attend. The Advisory Committee was developed primarily to allow interested parties and the general public a convenient forum to voice their ideas and concerns at no cost. The Advisory Committee quorum is 13 committee members.

Work Groups

Several Work Groups have been formed, and more may be formed in the future, to address specific topics. The Work Groups meet on an as-needed basis. The Work Groups present results from their work at regular Advisory Committee meetings. Any member or interested party can volunteer to serve on a Work Group. All interested individuals have the opportunity to serve on Work Groups. Volunteers generally serve as long as they wish or until a specific project is completed. Time commitments are typically no more than a few hours per week, since most volunteers also work full time for other agencies or organizations. A list of the Work Groups and their responsibilities is provided below:

Monitoring Work Group: Address regional surface water and groundwater monitoring topics such as California State Groundwater Elevation Monitoring Program (CAGEMP), Groundwater Management Plan (GWMP) updates, Irrigated Lands Regulatory Program (ILRP), Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS), etc.

Projects Work Group: Maintain list of proposed projects, develop project ranking criteria, and rank and prioritize projects proposed for funding.

Model and Data Work Group: Coordinate development and use of the Kings Basin Integrated Groundwater and Surface Water Model (Kings IGSM) including data collection, review of model results, and improvements and upgrades to the model. Other models and data sources may be used as they become available or necessary.

IRWMP Update Work Group: Provide input on updates and amendments to the IRWMP.

Disadvantaged Communities Work Group: Prepare grant applications for projects in DACs. Perform studies intended to help DACs with water resources problems.

Outreach Work Group: Perform public outreach efforts to engage the public in the Authority's efforts, recruit new members and interested parties, and increase awareness of local water management problems and the successes of the Authority. Develop public outreach media including flyers, websites, etc.

Ad Hoc Budget Committee: Discuss topics related to finances for the Authority including annual assessments, reserve accounts, project financing, operational costs, etc.

Boundaries Work Group: Discuss and coordinate recommendations on revising the Authority's boundary as requests to do so arise.

2.4 Decision Making

Decisions for the Authority are ultimately made by the Board of Directors. The decisions fall into three general categories as described below:

1. Minor Decisions. Decisions that do not have a material effect on long-term activities or policies of the Authority, such as approving minutes, administrative decisions, or incurring expenses less than $10,000. Minor Decisions require affirmative vote by 50% of the Board.
2. Major Decisions. Any decision that is not a Minor or Supermajority Decision. Adopting an updated IRWMP or selecting a Project are examples of a Major Decision. The special process for selecting projects is discussed further in Chapter 7 – Project Review Process. Major Decisions require the affirmative vote of two-thirds of the Board present at a meeting.
3. Supermajority Decisions. Decisions of high importance to the Authority such as whether to issue bonds or initiate litigation. Supermajority Decisions require the affirmative vote of two-thirds of all of the seventeen Board members.

The Advisory Committee has been part of the governance since the formation of the Authority to help inform the Board and offer all members, interested parties, and the general public an opportunity to provide input that can assist in decision making. Board meetings also include an agenda item for public comments, during which any interested party or member of the public can directly address the Board.

2.5 Stakeholder Participation

Balanced Opportunity for Participation

The governance structure helps ensure a balance of interested parties participate in the IRWMP process through the following policies and procedures:

- Advisory Committee. The Advisory Committee was established to advise the Board of Directors and also give interested parties a voice in regional water management. Interested parties are not formal members and are not required to pay annual assessments. This allows parties to participate even if they do not have the ability to pay the assessments required from Members.
- Work Groups. Work Groups perform the majority of work for the IRWMP development and on-going projects. Any member or interested party can serve on a Work Group.
- General Public. Advisory Committee and Board of Directors meetings are open to the general public, and each includes an agenda item for comments from the general public. These meetings are also conducted according to the Ralph M. Brown Act (California Government Code Sections 54950, et seq.), thus ensuring that the public can attend and participate in all official meetings.
- Board of Directors. Each member of the Board of Directors has one vote, regardless of size or financial resources of the agency they represent. This provides equal representation of all formal members.

These policies have worked successfully in engaging a diverse group of members and interested parties, as evidenced by the varied participants described in Section 2.1.

Communication

The Governance structure helps to foster adequate communication primarily through the Advisory Committee, Work Groups and Board of Directors. Communication is also enhanced by the public outreach efforts developed and implemented by the Outreach Work Group (see Section 2.4). The Authority performs a wide variety of public outreach efforts, which are described in Chapter 15 – Stakeholder Involvement.

2.6 IRMWP Implementation

Long-Term Implementation

The governance structure helps to ensure long-term implementation of the IRWMP through the following policies and procedures:

- Annual Assessments. Each member must pay an annual assessment, which is determined by the Board at the beginning of the fiscal year and is based on funding needed to pay for all anticipated operational expenses. These funds ensure a long-term self-sustaining organization.
- Reserve Fund. The Authority has established a Reserve Fund Policy (Policy No. UKB-004) that establishes a target amount of $500,000 for reserve funds. These reserve funds could allow the Authority to continue operating when expenses exceed their annual revenue.
- Advisory Committee. The Advisory Committee provides an opportunity for all stakeholders to participate and voice their opinions, ideas and concerns. This

creates an open and transparent process that is widely supported, and likely to be supported in the future, by the local water agencies and stakeholders.

- Joint Powers Agreement. The Members have all signed a Joint Powers Agreement outlining the governance structure for the Authority. Members can remove themselves from the Agreement, but by signing it they have expressed interest in a long-term commitment to regional water management. The JPA provides stability to the Authority and helps to ensure that it will be active in the long-term.

Coordination with Neighboring IRWMPs

The Authority takes several steps to coordinate with neighboring IRWMPs including:

- Letter of Agreement with Madera Regional Water Management Group (**Appendix D**)
- Participation in IRWMP 'Round Table of Regions' meetings, a statewide effort to bring all IRWMPs together to discuss important issues.
- Regularly attending meetings for the Tulare Basin Integrated Regional Planning Effort, a regional collaboration by several IRWMPs to discuss inter-regional topics in the Tulare Lake Basin, and active participation in sub-committees considering issues for the Tulare Basin, such as climate change
- Coordination with the Tulare Basin Watershed Initiative which works throughout the Tulare Lake Hydrologic Region.
- The Authority is on the mailing list for the Madera IRWMP and Westside San Joaquin IRWMP, and they in turn are on the mailing list for the Authority. This provides the different IRWMP groups information about on-going efforts and meeting times, locations, and agenda.
- The Authority frequently communicates with other IRWMPs regarding common regional water management projects, such as the California Statewide Groundwater Elevation Monitoring Program or the Irrigated Lands Regulatory Program.

Establishment of Plan Objectives

The IRWMP Goals and Objectives were established with the assistance of an IRWMP Update Work Group and the Advisory Committee, which were both formed by the Authority as part of its powers. This involved a collaborative process including members, interested parties, the general public, and participants from a variety of agencies and organizations. The Advisory Committee presented the recommended Goals and Objectives to the Board of Directors, who approved them when the IRWMP was adopted.

IRWMP Updates

The Authority has established a goal of updating the IRWMP every 5 years, or as needed to satisfy new IRWMP standards established by DWR. To document on-going progress, the Authority plans to prepare an annual report which will include a revised project list,

changes to policies and procedures, and other relevant information that should be included in the IRWMP. These annual reports will be considered attachments to the current IRWMP, and the information will be formally incorporated into the IRWMP when it is updated. Refer to Chapter 9 – Plan Performance and Monitoring for more information on the annual reports.

IRWMP updates will be led by the IRWMP Update Work Group (See Section 2.4). The Advisory Committee will review and comment on the revised IRWMPs and present a recommended IRWMP to the Board of Directors for formal adoption. According to the JPA, amendments to the IRWMP must be adopted by the Board of Directors as a Major Decision.

The Authority will seek grant funds for updating the IRWMP but recognizes that they may not always be available. Consequently, the Authority has established a Reserve Fund Policy (Policy No. UKB-004) that establishes a target amount of $500,000 for reserve funds. IRWMP updates were identified as one of the primary tasks that could be funded with the reserve funds.

3 REGION DESCRIPTION

3.1 Introduction

This chapter describes the physical conditions, water infrastructure, and stakeholders in the Integrated Regional Water Management Plan (IRWMP) area. The purpose of this section is to summarize regional water resources data, so all stakeholders have the necessary background data to participate in regional planning and decision making. Specific topics that are discussed include:

- Watersheds/Water System
- Internal Boundary
- Water Supply and Demand
- Water Quality Conditions
- Major Water Related Objectives and Conflicts
- Regional IRWM Boundary
- Neighboring or Overlapping IRWM Regions

3.2 Watershed/Water System Description

3.2.1 Physical and Hydrological Conditions

The Kings River is the major source of surface water in the Kings Groundwater Sub-basin (Kings Groundwater Basin or Kings Basin) and the region is reliant on surface water supplies derived primarily from the Kings River. Pine Flat Reservoir regulates the flow on the Kings River and provides storage, flood control, and recreational benefits. The Kings River is a natural river along much of its upper reaches, while its lower reaches have been re-channeled and include many weirs, diversion structures, and levees.

The San Joaquin River defines the northern boundary of the IRWMP Region. It is a source of both surface water supply and groundwater recharge in the Kings Basin. Several entities have water entitlements from the Central Valley Project (CVP) Friant Division and divert San Joaquin River water into the area via the Friant-Kern Canal under temporary or permanent contracts with the CVP. Some CVP flood water releases are also utilized intermittently by these entities in the region.

An extensive network of canals is used to deliver water to agricultural lands, to existing groundwater recharge facilities, and to a few surface water treatment facilities. Although the weirs, diversion structures, canals, and recharge facilities are managed by different local and regional water agencies, they are all part of a single interconnected physical and hydrologic system. The stakeholders in the area use similar surface water supplies; however, the boundary of the Kings Groundwater Sub-basin was the primary foundation for delineating the IRWMP boundary, as discussed in the following section.

3.2.2 Groundwater Basin Boundaries

The Kings Basin is a large groundwater subbasin located within the southern part of the San Joaquin Valley Basin, in the Central Valley of California. The groundwater basin boundaries as defined in the Department of Water Resources (DWR) Bulletin 118 are shown in **Figure 3-1.** The KBWA boundary predominantly covers the Kings Subbasin, but the boundary also covers small portions of the Delta-Mendota, Tulare Lake and Kaweah subbasins. All of these subbasins have been identified as critically overdrafted, high-priority groundwater basins.

The Kings subbasin covers an area of 1,530 square miles. The current IRWMP region, as defined above, includes the majority of the Kings Groundwater Basin. DWR estimates that the groundwater storage for the entire Kings Basin is about 93 million acre-feet (AF) to a depth of more than 1,000 feet (DWR Bulletin 118, 2003). The Kings Basin, consisting primarily of lands served by Alta Irrigation District (AID), Consolidated Irrigation District (CID), and Fresno Irrigation District (FID), accounts for a large percentage of the groundwater pumping in the region. The Upper Kings Basin has a total groundwater storage capacity of 35 million acre-feet (AF) to an average depth of about 500 feet (KRCD, 1993). The groundwater storage in the Lower Kings Basin is estimated to be about 44 million AF to an average depth of about 1,000 feet (WRIME, 2005a). The Upper Kings Basin refers to approximately the northeastern two-thirds of the Basin, and the Lower Kings Basin refers to the southwestern one third (see **Figure 2-1** in 2007 IRWMP).

There are many land owners and multiple local and regional water agencies and irrigation districts that overlie the Kings Basin. This means that the actions of a groundwater user or an overlying land owner may have an effect on a number of other water users. The San Joaquin and Kings Rivers are hydraulically connected with the underlying groundwater basin and are major sources of recharge.

The Kings Groundwater basin has an extensive monitoring network. The Kings River Conservation District (KRCD) obtains water levels from about 1,100 wells in the region based on monitoring records from 19 local agencies. This extensive data was used in the IRWMP plan development and associate technical analysis, including modeling.

3.2.3 Environmental Resources

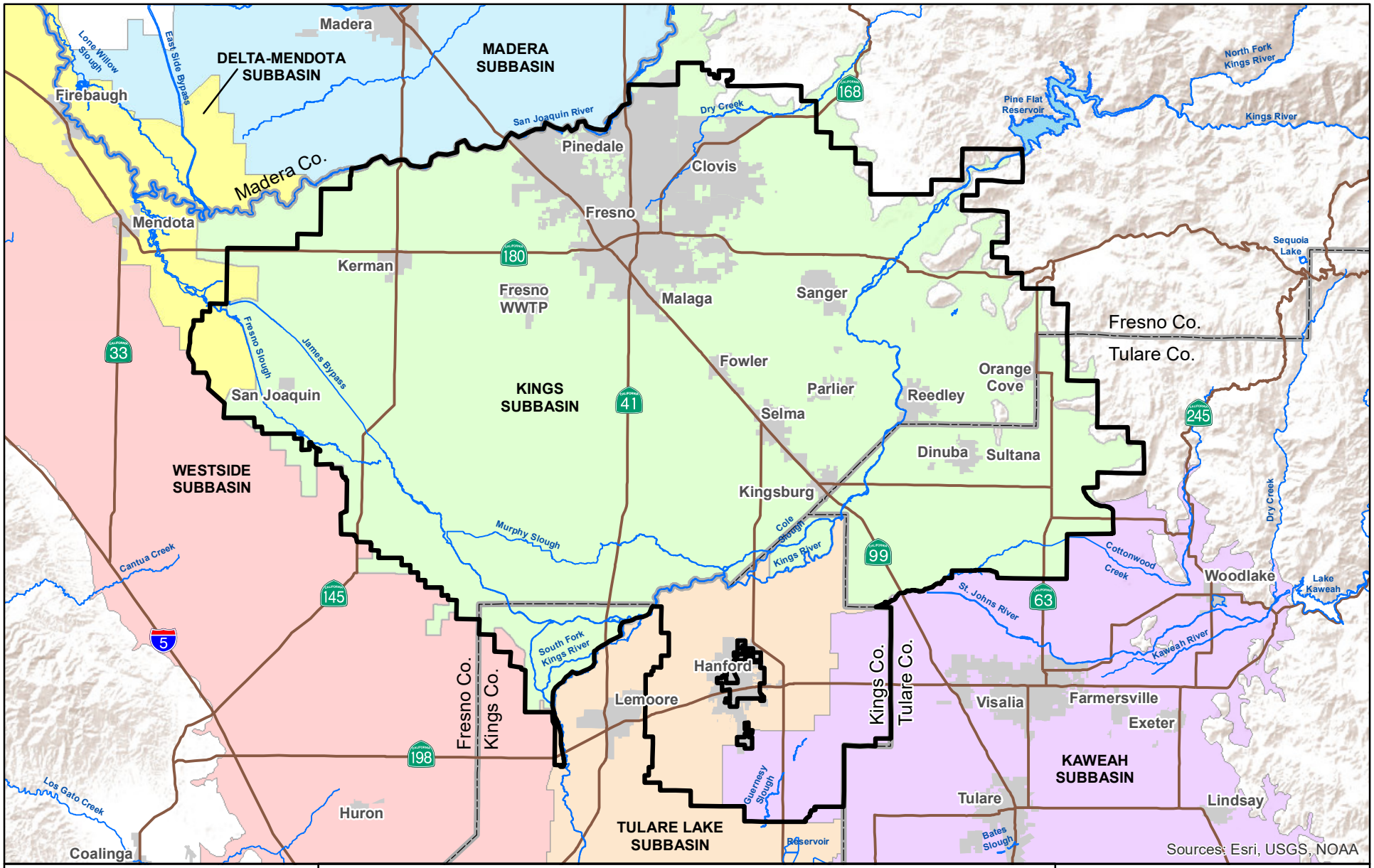
KRCD staff documented the Environmental Baseline Conditions in the Kings Region (KRCD, 2006b). The purpose of the document was to provide a baseline of existing biological and habitat resources in the Kings Region. It describes the biotic regions, plant and wildlife habitats, wildlife and fish species, special status species, wetland, regulatory setting and agencies, standards of significance for environmental impacts and the potential biological impact in the Kings Region. The information was compiled to guide the planning and siting of projects in order to avoid impacts to biological resources; expedite preparing project initial studies or California Environmental Quality Act (CEQA) documents; support resolution of permitting issues; and reduce the potential for project delays due to unforeseen environmental constraints. The compiled information may also

help identify how to incorporate environmental benefits into project plans. Technical support for environmental efforts is provided by Tulare Lake Hydrologic Region Watershed Coordinator and supplemented by other member and Interested Party stakeholders representing the environmental community.

Rapid development often tends to create ecosystem imbalances that have long-term adverse impact on a region. Therefore, proper identification and protection of areas of special biological significance and sensitive habitats is an essential component of a successful IRWMP. The currently known areas of special biological significance and other sensitive habitats are described below.

3.2.4 Kings River

The Kings River is the main river in the project study area and the lower San Joaquin Valley. The river runs through Fresno, Tulare, and Kings Counties, and is the best and most prominent riparian and wetland habitat in these counties. The river and its associated habitat are special areas of biological significance. The Kings River, its tributaries, and sloughs are the lifeline of riverine-riparian habitat that links the Sierra Nevada Mountains to the foothills to the valley floor. Historically, the Kings River has been linked to the Tulare Lake, the expansive wetlands in the Kerman-Mendota area, and the San Joaquin River through manmade conveyances, and northward to the Sacramento Delta. These areas have considerable fish, wildlife, and habitat resources. The habitat linkages and resources still exist but have been reduced and degraded over the last century. The river and its riparian habitat are the main corridors for fish and wildlife movements. The river is a major stopover habitat for birds migrating south from the Sierra Nevada Mountains, western United States, and even Canada. Such birds range from small warblers to the bald eagle. The flood corridor also provides a buffer between the river and the adjacent farmland and towns.



KINGS BASIN Water Authority

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Miles

Kings Basin IRWMP

City

County

CA DWR Bulletin 118 Subbasin (2017)

Madera

Delta-Mendota

Westside

Kaweah

Tulare Lake

Kings

FIGURE 3-1

Kings Basin IRWMP

Groundwater Subbasin Boundaries

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3.2.5 Conservation Areas

The IRWMP Region is geographically located among several important conservation areas. Important conservation areas in the region include the San Joaquin River to the north, Sierra and Sequoia National Forests to the east, and the Griswold, Tumey, and Panoche Hills to the west. Important conservation areas closer to the IRWMP Region include a 6,000-acre Wetland Reserve Program parcel near Helm, another 1,000-acre Wetland Reserve Program parcel near Lemoore, the 12,000-acre Mendota Wildlife Management Area, the 3,000-acre Alkali Sink Ecological Reserve and Kerman Ecological Reserve near Kerman, lands on the Lemoore Naval Air Station near Lemoore, and a 500-acre sensitive plant preserve near Piedra. Also, small parcels of native grassland and alkali sink habitats that have not been developed or farmed are scattered throughout the valley. A few developed and undeveloped county parks occur near the Kings River, which provide open space, wildlife habitat, and recreation. Such parks include Avocado Lake Park, Green Belt Parkway, China Creek Park, Laton-Kingston Park, and Burris Park. The Tulare Basin Wildlife Partners (TBWP), an Interested Party of the IRWMP, is a non-profit organization with a mission to facilitate conservation projects in the Tulare Basin. They have developed a list of over 45 potential conservation projects in the area (Tulare Basin Wildlife Partners, 2013)

The conservation areas provide riverine, riparian, wetland, Valley Oak woodland, annual grassland, and alkali sink habitats that are all unique. Such areas are known to have a high abundance and diversity of fish and wildlife, including both resident and migratory populations. The areas are also habitat for threatened, endangered, and sensitive species such as the Valley Elderberry Longhorn Beetle, San Joaquin Kit Fox, American Badger, Giant Garter Snake, Western Pond Turtle, Swainson's Hawk, Tricolored Blackbird, Burrowing Owl, California Jewelflower, and Keck's Checkerbloom.

3.2.6 Protected Areas and Impaired Water Bodies within the Region

The State Water Resources Control Board (SWRCB) develops a list of water quality limited stream segments or water bodies, known as a 303(d) list pursuant to the Clean Water Act (1972), Article 303(d). This list indicates whether the water body is meeting the needs of the designated beneficial use as a result of known water quality problems. The latest available 303(d) list was updated by the SWRCB and the Regional Water Quality Control Board (RWQCB) in 2010. It includes the segments of the north and south forks of the Kings River from Pine Flat to Island Weir and Island Weir to the Stinson and Empire Weirs. The Kings River in the Pine Flat to Island Weir reach has elevated levels of Chlorpyrifos and Unknown Toxicity. The Kings River in the Island Weir to Stinson and Empire Weirs reach has elevated levels of electrical conductivity, molybdenum, and toxaphene. The 303(d) list gives the reach a low priority for the development of a Total Maximum Daily Load (TMDL).

Mendota Pool, on the western edge of the Kings Basin is also included in the 303(d) list and has been defined as impaired by elevated mercury levels potentially because of

resource extraction and elevated selenium levels, potentially because of agriculture, groundwater withdrawal, or other sources. The 303(d) list also gives Mendota Pool a low priority for the development of a TMDL. The Lower Kings Basin is not likely a significant contributor to the issues at Mendota Pool, but could be affected by water quality issues should Mendota Pool water be considered as a source of water for recharge or treated for potable use.

3.2.7 Important Ecological Processes and Environmental Resources

The majority of the IRWMP Region has been ecologically modified through urbanization and agriculture, making the remaining habitat limited and valuable. The IRWMP will seek to integrate and incorporate the existing resource protection strategies and policies, as defined in the prevailing land use plans, with the water resources strategies as part of the development of the IRWMP. KRCD, the Kings Basin Water Authority (Authority), and Nongovernmental Organizations (NGOs) will work with the responsible and trustee agencies through early consultations to collect prior studies and resources inventories so that contemporary information on ecological processes and environmental resources are included in the IRWMP. The information will be used to conduct preliminary environmental evaluations and to screen water management strategies and IRWMP alternatives. The information will also be used to: (1) influence project designs and avoid impacts, and (2) identify opportunities to enhance or improve conditions for the purposes of providing regional benefits.

3.2.8 Wetlands and Riparian Resources

The rivers and streams that flow from the Sierra Nevada Mountains historically meandered through broad floodplains in the San Joaquin Valley. Because of urbanization and agriculture, these broad floodplains have been restricted to narrower belts along the rivers and streams or otherwise modified for flood control. Within this modified landscape, remaining riparian habitat is of great value to resident and migratory animal species as it provides corridors and linkages to and from the biotic regions of the county. The numerous essential habitat elements provided by the remaining riparian/riverine corridors in the area make them perhaps the most significant contributor to wildlife habitat throughout the region. The Kings Basin still contains large wetlands and wildlife refuge areas, while the foothills contain vernal pools. These areas support many specialized plant and animal species. Existing county and city policies will be referenced to provide guidance to the IRWMP and to make the goals, policies, and objectives of the land use or regional habitat conservation plans part of the regional program. Avoidance, minimization, and mitigation will be provided in project designs by project proponents and used to rank and evaluate alternatives for the development of the IRWMP. KRCD also maintain waterways under permits for maintenance that protect and minimize impacts to habitat.

3.2.9 Fish and Wildlife Habitat

The Region includes a range of habitats that are found from the crest of the Sierra Nevada Mountains, through the foothills of the Sierra Nevada, and into the San Joaquin Valley. Different parts of the region can be described in terms of 29 distinct habitat types based on the composition and structure of vegetation found in each area. Within these habitats, there is a close relationship between natural vegetation and wildlife. The disruption of natural vegetation areas alters the food chain upon which many animals are dependent. The preservation of natural vegetation areas is, therefore, key to the abundance and wellbeing of many wildlife species. Existing land use and habitat management policies will be documented and used to ensure compliance and consistency with current goals to protect natural areas and preserve the diversity of remaining habitats in the Region.

3.2.10 Climate Change

Climate change is an issue of concern in the Kings Basin and is discussed extensively in Chapter 17.

3.3 Internal Boundary Description

The IRWMP Region is well defined, as shown in **Figure 3-1,** which also shows the Kings Groundwater Basin. The IRWMP Region consists of the geographic areas under the jurisdiction of the IRWMA members and includes the majority of the Kings Groundwater Basin as defined by DWR Bulletin 118 Update 2003. The total land area of the IRWMP region is approximately 1,123,000 acres with an irrigated land area of about 760,000 acres.

The IRWMP Region also includes regional and smaller local water agencies and spans over parts of three counties: Fresno, Kings, and Tulare. The irrigation districts, county boundaries and the city limits and spheres of influence within the IRWMP Region are shown in **Figure 3-2** and **Figure 3-3**. The urban spheres of influence and current city boundaries are important because the water districts and urban entities need to work together to ensure compatibility and consistency between the prevailing land use and water supply plans for the area.

3.3.1 Jurisdictional Authorities

The success of an IRWMP depends on the participation of those agencies that have jurisdictional authority to implement the plan. Therefore, jurisdictional authority is used as an important basis for defining the boundary of the IRWMP Region. Both land use and water supply authorities are needed to effectively develop and implement the plan and, as such, the IRWMA includes representatives from the overlying counties, incorporated cities, and the water districts and agencies **Figure 3-2**, presented earlier, shows the irrigation districts in the IRWMP Region.

3.3.2 Members and Interested Parties

The IRWMA is comprised of 17 members and 40 interested parties, as discussed in Chapter 2. **Table 3-1** lists those agencies and organizations. **Table 3-2** shows the agency classification per California Water Code (CWC) §10541(g)y. A description of each member and interested party is provided in **Appendix A**.

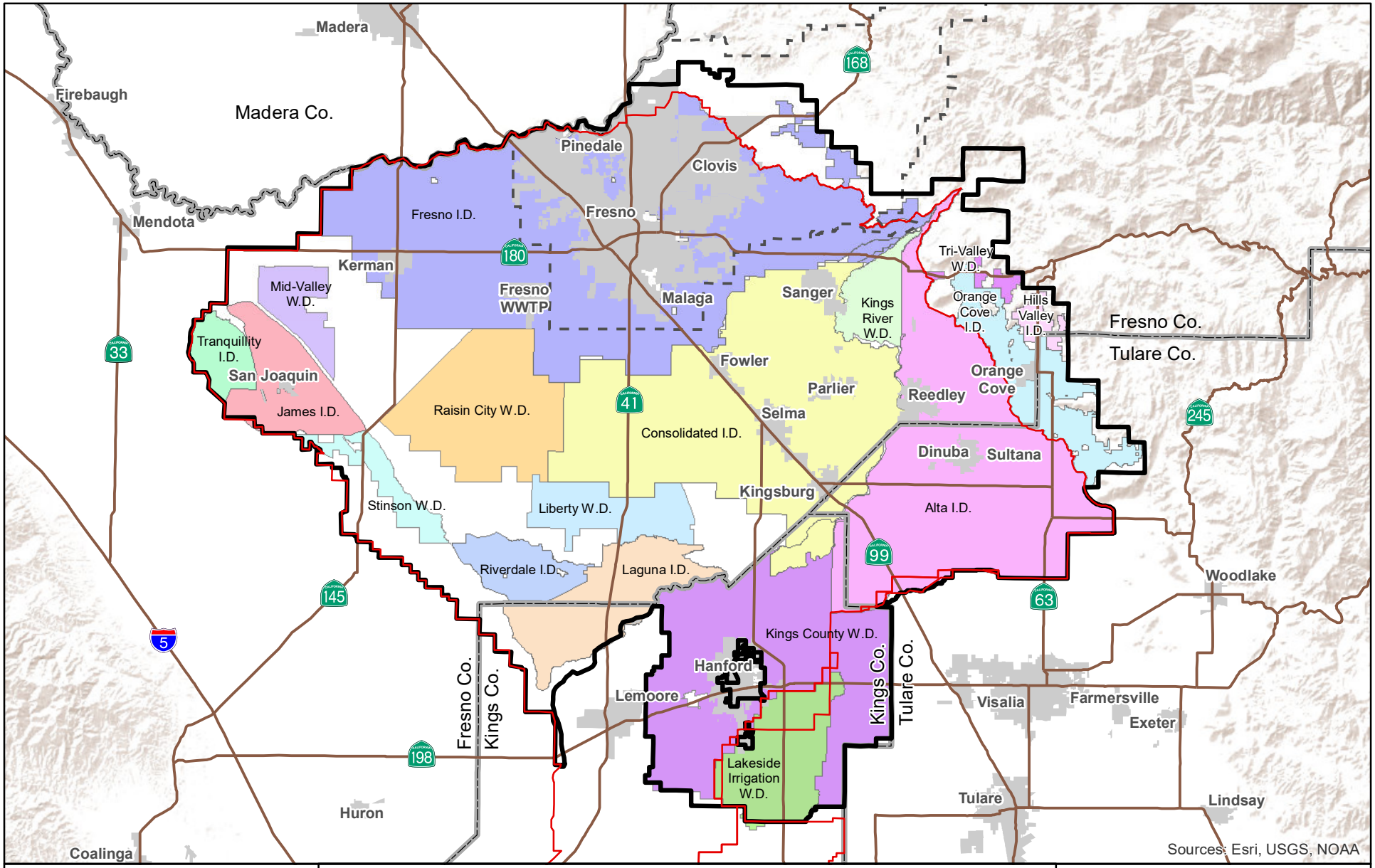

FIGURE 3-2

Kings Basin IRWMP

District, County and Urban Areas within IRWMP Region

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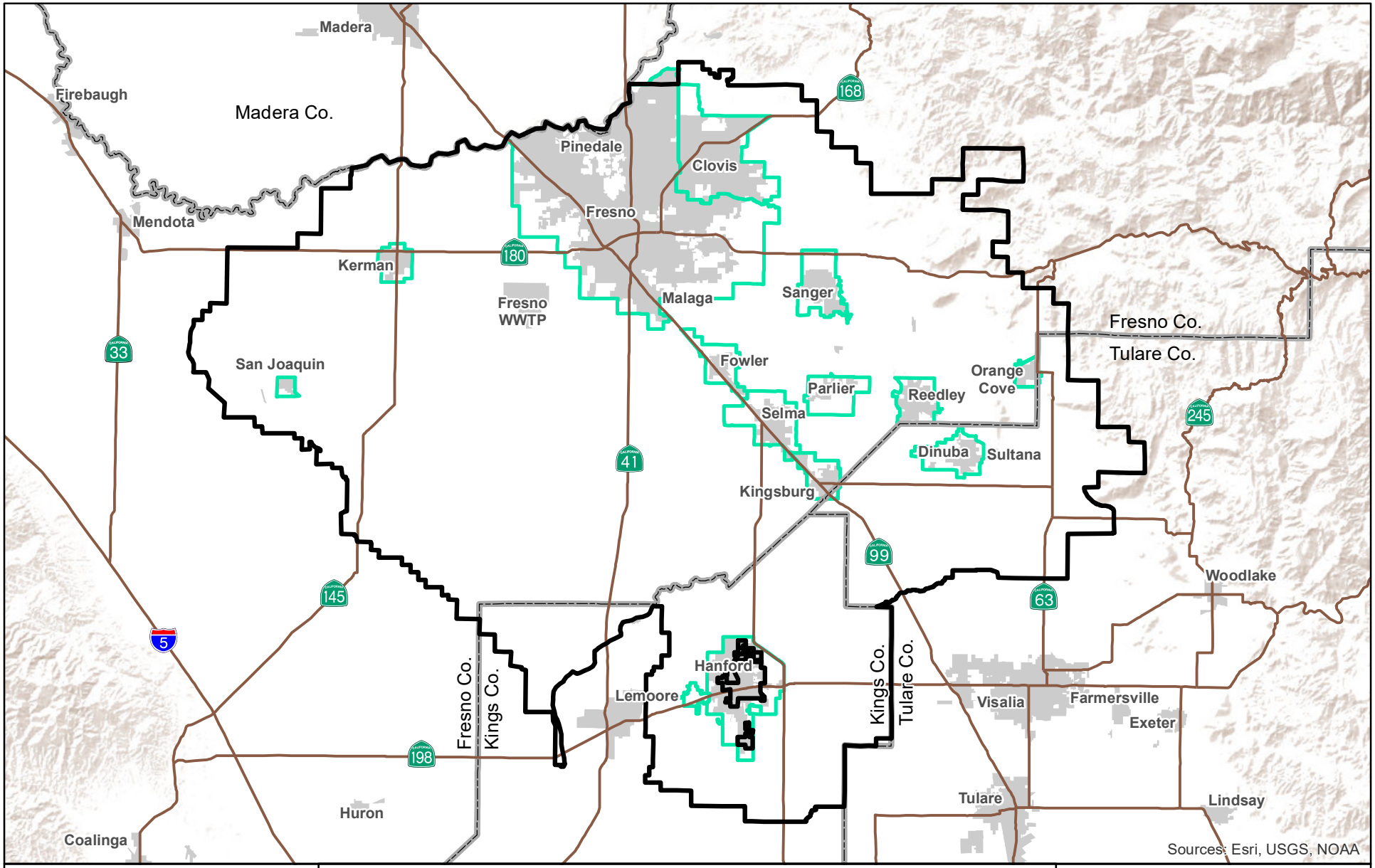

KINGS BASIN Water Authority

0 3 6 Miles

- Sphere of Influence
- Kings Basin IRWMP
- City
- County

FIGURE 3-3

Kings Basin IRWMP

Spheres of Influence within IRWMP

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Table 3-1: Members and Interested Parties

Members	Interested Parties
Alta Irrigation District	Armona Community Services District
City of Clovis	Bakman Water Company
City of Dinuba	Biola Community Services District
City of Fresno	California Native Plant Society
City of Kerman	California State University, Fresno
City of Parlier	City of Kingsburg
City of Reedley	City of Orange Cove
City of Sanger	City of San Joaquin
City of Selma	Community Water Center
County of Fresno	County of Kings
County of Tulare	Crescent Canal Company
Consolidated Irrigation District	Cutler Public Utility District
Fresno Irrigation District	East Orosi Community Services District
Fresno Metropolitan Flood Control District	Easton Community Services District
Kings County Water District	El Rio Reyes Conservation Trust
Kings River Conservation District	Hardwick Water Company
Raisin City Water District	James Irrigation District
	Kings River Conservancy
	Kings River Water Association
	Laguna Irrigation District
	Lanare Community Services District
	Laton Community Services District
	Liberty Canal Company
	Liberty Water District
	London Community Services District
	Malaga County Water District
	Mid-Valley Water District
	Orosi Public Utility District
	Pinedale County Water District
	Reed Ditch Company
	Riverdale Irrigation District
	Riverdale Public Utility District
	Sanger Environmental Fund
	Self-Help Enterprises
	Sierra Club, Tehipite Chapter
	Sierra Resource Conservation District
	Sultana Community Services District
	Terranova Ranch, Inc.
	Tulare Basin Wildlife Partners
	University of California Cooperative Extension – Fresno County

Table 3-2: Stakeholder Classification

Organization	Stakeholder Classification												
	Wholesale and retail water purveyors	Wastewater agencies	Flood control agencies	Municipal/County Governments & Special Districts	Electrical corporations	Native American tribes	Self-supplied water users	Environmental stewardship	Community organizations	Industry organizations	State, Federal, & Regional Agencies/Universities	Disadvantaged communities	Other groups
Alta Irrigation District	X			X									
City of Clovis	X	X		X			X						
City of Dinuba	X	X	X	X			X					X	
City of Fresno	X	X		X			X					X	
City of Kerman	X	X	X	X			X					X	
City of Parlier	X	X	X	X			X					X	
City of Reedley	X	X	X	X			X					X	
City of Sanger	X	X	X	X			X					X	
City of Selma		X	X	X			X					X	
County of Fresno				X									
County of Tulare				X									
Consolidated Irrigation District	X			X									
Fresno Irrigation District	X			X									
Fresno Metropolitan Flood Control District			X	X									
Kings County Water District				X									
Kings River Conservation District			X	X				X			X		
Raisin City Water District	X			X			X					X	
Armona Community Services District	X	X		X			X					X	
Bakman Water Company	X						X					X	

Organization	Stakeholder Classification												
	Wholesale and retail water purveyors	Wastewater agencies	Flood control agencies	Municipal/County Governments & Special Districts	Electrical corporations	Native American tribes	Self-supplied water users	Environmental stewardship	Community organizations	Industry organizations	State, Federal, & Regional Agencies/Universities	Disadvantaged communities	Other groups
Biola Community Services District	X	X	X	X			X					X	
California State University, Fresno											X		X
California Native Plant Society, Sequoia Chapter								X					
City of Kingsburg	X	X	X	X			X						
City of Orange Cove	X			X			X					X	
City of San Joaquin	X	X	X	X			X					X	
Community Water Center									X				
County of Kings				X									
Crescent Canal Company	X												X
Cutler Public Utility District	X	X		X			X					X	
East Orosi Community Services District	X	X		X			X					X	
Easton Community Services District			X	X								X	
El Rio Reyes Conservation Trust								X					
Hardwick Water Company	X						X					X	
James Irrigation District	X			X									
Kings River Conservancy								X					
Kings River Water Association								X					
Laguna Irrigation District	X			X									
Lanare Community Services District	X			X								X	

Organization	Stakeholder Classification												
	Wholesale and retail water purveyors	Wastewater agencies	Flood control agencies	Municipal/County Governments & Special Districts	Electrical corporations	Native American tribes	Self-supplied water users	Environmental stewardship	Community organizations	Industry organizations	State, Federal, & Regional Agencies/Universities	Disadvantaged communities	Other groups
Laton Community Services District	X	X		X			X					X	
Liberty Canal Company	X												X
Liberty Water District	X			X			X						
London Community Services District	X	X		X			X					X	
Malaga County Water District	X	X		X			X					X	
Mid-Valley Water District	X			X									
Orosi Public Utility District	X	X		X			X					X	
Pinedale County Water District	X			X			X					X	
Reed Ditch Company	X												
Riverdale Irrigation District	X			X									
Riverdale Public Utility District	X	X	X	X			X					X	
Sanger Environmental Fund								X					
Self-Help Enterprises													X
Sierra Club, Tehipite Chapter								X					
Sierra Resource Conservation District													X
Sultana Community Services District	X	X		X			X					X	
Terranova Ranch, Inc.							X						X
Tulare Basin Wildlife Partners								X					
University of California Cooperative Extension											X		X

3.3.3 Water Districts/Special Districts

General and special districts are the two major types of water districts. General districts like AID, CID, and FID are formed under specific sections of the state code that define the procedures, powers, authorities, and other characteristics of the district. Special districts like KRCD or the Fresno Metropolitan Flood Control District (FMFCD) are formed by special acts of the legislature creating the districts and prescribing their powers. In addition, there are many types of districts formed, such as public utility districts and community services districts, to provide unique or specialized services to local land owners. Each of the districts has specific powers and authorities, governance, electoral processes, funding mechanisms, and programs for its jurisdiction. Water districts, private ditch companies, and municipal water service providers located in and around the IRWMP area are shown in figures provided in Chapter 3.

3.3.4 Mid-Valley Water Authority

The Mid-Valley Water Authority (MVWA) is a Joint Powers Authority (JPA) that was created to secure a supplemental water supply and to support the construction of a conveyance facility for the delivery of supplemental water to the MVWA service area; KRCD is the lead agency. The MVWA was formed in 1982 with 30 public agencies, though currently the MVWA has 20 agencies and has become relatively inactive. The service area extends from Merced County in the north to the southern boundary of the Arvin-Edison Water Storage District (AEWSD) and includes approximately 3.4 million acres. The MVWA completed the San Joaquin Valley Conveyance Investigation in cooperation with Reclamation. The Central Valley Project Improvement Act (CVPIA) has precluded the MVWA from obtaining a water supply from the CVP until certain environmental objectives are obtained and stalled further development of the proposed conveyance and delivery facilities. Currently, there are no active plans or projects for the MVWA.

3.3.5 Community Services Districts, Public Utility Districts, and County Service Areas

Both Community Services Districts (CSD) and Public Utility Districts (PUD) provide water, sewer, and other public services to unincorporated communities. CSDs are formed under California Government Code §61000 et seq and PUDs are formed under California Public Utility Code §15501 et seq. Both types of Districts have their own locally elected five-member board of directors. There are 15 CSDs and PUDs in the IRWMP Region, 10 of which are Interested Parties. The following is a list of CSDs and PUDs located within the IRWMP boundary:

Fresno County: Biola CSD, Caruthers CSD, Del Rey CSD, Easton CSD, Lanare CSD, Laton CSD, Riverdale PUD, Tranquillity PUD

Tulare County: East Orosi CSD, London CSD, Sultana CSD, Cutler PUD, Orosi PUD

Kings County: Armona CSD and Home Garden CSD

The county Local Agency Formation Commission (LAFCO) keeps track of the various special districts within each county, maintains maps of the service area, and approves municipal service reviews and any boundary changes. The county LAFCOs also maintain maps of the districts. Many of the CSDs and PUDs provide service to small areas with limited tax bases and many of the areas served are rural and can be defined as disadvantaged communities. Many of these small public agencies have limited management or technical capacity and are constrained by limited funding.

There are many small County Service Areas (CSAs) within the IRMWP region that provide water and/or sewer service. In the Fresno County portion of the IRWMP Region, water service only is also provided by CSAs 5 (Wildwood Estates), 10 (Cumorah Knolls and Mansionette Estates), 14 (Belmont Country Club), and 42 (Raisin City). These are very small service areas with a limited number of connections. These areas have a wide range of needs, some of which are further discussed in the disadvantaged community section of this report. In Tulare County, CSA #2 encompasses most of the unincorporated portions of that county. Tulare County has elected to form Zones of Benefit where water and/or sewer services are needed in this countywide county service area. Within the boundaries of the IRWMP are the Delft Colony, Seville, Traver and Yettem Zones of Benefit.

3.3.6 Resource Conservation Districts

Resource Conservation Districts (RCDs) are established locally under the provisions of Division 9 to the Public Resource Code and LAFCO rules for each county. RCDs have close ties to county governments, but have their own locally appointed, independent boards. RCDs are grass roots organizations that undertake projects for soil and water conservation, wildlife habitat enhancement and restoration, watershed restoration, conservation planning, and education. RCDs are usually technically supported by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service). RCDs have become more active in the past 10 years with increased emphasis on watershed planning and water quality protection. There are two RCDs that are active in the IRWMP Region: the Navelencia Resource Conservation District and the Tulare County Resource Conservation District. The Sierra RCD is an interested party and is located outside of the IRWMP area but covers watershed lands that provide water to the region. No specific comprehensive watershed plans, projects, or programs have been identified that would serve as an action for the IRWMP.

3.3.7 Water Associations

Water associations are private groups, which work together to represent the interests of their members. KRWA, the Friant Water Authority, and the Kings River Water Quality Coalition are three such associations in the IRWMP area.

3.3.7.1 Kings River Water Association

The history of water management on the Kings River is marked by numerous disputes over water rights. These disputes eventually led to the formation of the Kings River Water Association (KRWA) as a way to solve disputes and to coordinate water management along the river. Under a series of complex agreements and water schedules documented in the "Blue Book," KRWA serves as the water master to manage the Kings River flow and the conserved storage in Pine Flat Reservoir. KRWA is comprised of 28, member agencies that have contracts for the 1,006,000 AF of conserved storage in Pine Flat Reservoir.

The boundaries of KRWA define the Place-of-Use for the Kings River water rights held by KRWA in trust for the individual members. The Place-of-Use must be defined in the water rights permits issued by the SWRCBD. The areas outside of the KRWA boundaries that do not have surface water rights to the Kings River or CVP supplies are reliant on groundwater. Under KRWA policies, surface water can be transferred between KRWA members within the adopted KRWA Place-of-Use. Through KRWA, members pay for irrigation storage benefits on the Pine Flat Dam and for retirement of the bonds and obligations to the federal government.

3.3.7.2 Friant Water Authority and CVP Contractors in the IRWMP Region

The Friant Water Authority (FWA) represents Friant Division CVP Contractors that house federal water contracts with Reclamation. The Friant Division includes Millerton Lake, the Madera Canal, Friant-Kern Canal, and associated facilities. The Friant-Kern Canal crosses the IRWMP Region and is operated and maintained by the Friant Water Authority. The region also includes entities that receive water from the Mendota Pool Unit of the CVP. The Delta-Mendota Canal (DMC) ends at Mendota Pool, just north and west of the IRWMP Region, and provides water to these federal contractors. The CVP Contractors in the IRWMP area are shown in **Table 3-3.**

Table 3-3: CVP Contractors in IRWMP Area

Contractor	Contract Date	Duration	Type	Entitlement (AF)	Use
Fresno Irrigation District	January 2012	Permanent Contract	Class 2	75,000	M&I and Irrigation
Garfield Water District	January 2012	Permanent Contract	Class 1	3,500	Irrigation
International Water District	January 2001	25 years	Class 1	1,200	M&I and Irrigation
Orange Cove Irrigation District	January 2012	Permanent Contract	Class 1	39,200	M&I and Irrigation
City of Orange Cove	January 2001	25 years	Class 1	1,400	M&I
City of Fresno	January 2012	Permanent Contract	Class 1	60,000	M&I
Fresno County Waterworks District #18	January 2001	25 years	Class 1	150	M&I
Tranquillity Irrigation District	February 2005	25 years	Project Water	13,800	M&I and Irrigation
Tranquillity Public Utility District	February 2005	25 years	Project Water	70	M&I and Irrigation
James Irrigation District	February 2005	25 years	Project Water	35,300	M&I and Irrigation
Coelho Family Trust	February 2005	25 years	Project Water	2,080	M&I and Irrigation

Notes:
Project Water – Water from the Central Valley Project
M&I – Municipal and Industrial Users
Permanent Contract – Contractor has entered into a 9(d) repayment contract for capital repayment

The Friant Division provides two classes of water contract entitlement. Class 1 water is the most dependable supply and would normally be available in-whole or in-part for delivery each year. Class 1 water is typically contracted to districts that serve areas with limited or no access to groundwater of acceptable quality. Class 2 water is that supply in excess of Class 1 that is only periodically available for delivery. Because of uncertainty regarding availability and time of occurrence, Class 2 water is not as dependable as Class 1. Class 2 water is typically under contract to districts with access to good groundwater supplies or other surface water sources. These districts can accept recurring CVP deficiencies and rely primarily on their other sources of supply.

The Friant Water Authority is a key player in the plan to restore the San Joaquin River.

FID is the only CVP contractor in Fresno County that has a Class 2 contract entitlement. The City of Fresno has a Class 1 contract, which is unusual for a large urban center. This represents a secure source of supply, which is very important to the Fresno-Clovis Metropolitan Area.

3.3.7.3 Southern San Joaquin Valley Water Quality Coalition via the Southern San Joaquin MPEP Committee

KRWA and KRCD are participating in the SSJVWQC, which was established in 2002 to deal with water quality issues and concerns affecting the Kings River area and the Tulare Lake Basin. Some of the pending water quality issues identified by the SSJVWQC are:

- Expiration of the agricultural waiver exemption for water discharge requirements;
- The State and Regional Water Quality Control Boards' 303(d) list of impaired waterways to be used to calculate TMDL under the Clean Water Act; and
- The Regional Board's triennial review of the San Joaquin and Sacramento River Basin Plan includes examination of TMDL and water quality issues.
- Grower and Coalition compliance with the Tulare Lake Basin General Order, which includes addressing irrigated commercial agriculture surface water and groundwater quality issues.
- The seven SSJVWQC participating Coalitions believe that they will be better served approaching these and other water quality issues using a regional approach rather than individually.

3.3.8 Groundwater Sustainability Agencies

The Sustainable Groundwater Management Act (SGMA) became law in 2014 to provide framework for California to manage its groundwater resources at a local level through collaborative local agency initiative. It required that local agencies voluntarily form Groundwater Sustainability Agencies by July 1, 2017. The KBWA boundary primarily covers the Kings Subbasin, but does include portions of the Delta-Mendota, Tulare Lake and Kaweah Subbasins as shown in **Figure 3-1**. The Kings Subbasin is comprised of seven GSAs: North Kings, Kings River East, Central Kings, South Kings, North Fork Kings, McMullin Area, and James GSAs. The GSAs are required to prepare a Groundwater Sustainability Plan (GSP) by 2020 that includes a coordinated program with ongoing activities to be undertaken to benefit the basin.

3.3.9 Land Use Planning Agencies — Incorporated Cities and Unincorporated Communities

The incorporated cities, unincorporated communities, and county boundaries were shown in **Figure 3-2**. The IRWMP Region overlaps parts of Fresno, Tulare, and Kings Counties. The legal authority for the various city and county actions and programs is derived from two essential powers of local government: corporate and police powers. Using their corporate power, local governments collect money through bonds, fees, assessments, and taxes and spend it to provide services and facilities, such as police and fire protection, streets, water systems, sewage disposal facilities, drainage facilities, and parks. Using their police power, local governments regulate the use of private property through zoning, subdivision, and building regulations in order "to promote the health, safety, and welfare of the public." City and county general plans provide the formal framework for the exercise of these powers by local officials, for guiding land use decisions over a specified

planning horizon, and for making assumptions about the future for planning purposes. A city defines its planned growth over a specific planning horizon in the city's general plan. The city's defined growth area and Sphere of Influence (SOI) are important for forecasting future land use conversions from agricultural to urban uses and are used to determine future water requirements.

3.3.10 Local Agency Formation Commission

Fresno, Kings, and Tulare Counties' LAFCOs are responsible for overseeing the formation and boundary changes (jurisdictional areas) of cities and special districts. Proposals for reorganization or annexation are subject to review by the appropriate county's LAFCO under the Cortese-Knox-Hertzberg Local Government Reorganization Act of 2000 (CKHA) (CGC §56000). Annexation is the inclusion, attachment, or addition of territory to a city or district (CGC §56017) and can involve detachments from other special districts. The process is also referred to as reorganization. LAFCOs have numerous powers under the CKHA, but those of primary concern are the powers to act on local agency boundary changes and to adopt SOIs for local agencies and special districts.

For the IRWMP, the city and county general plan land use diagrams and LAFCO-approved SOIs provide the basis for calculation and evaluation of potential future water demands. A consolidated map of the SOIs in the IRWMP Region is presented in **Figure 3-3,** which shows the proposed and accepted future city boundaries at build-out. The SOI is established for the specific planning horizon as defined by the prevailing general plans for cities or as currently recognized for water districts that are the purveyors to the unincorporated community. Prior to updating an SOI, state law requires a LAFCO to approve a Municipal Service Review (MSR) for public services provided within the SOI.

3.3.11 State and Federal Agencies

The DWR IRWMP Standards state that an IRWMP needs to identify state or federal agencies involved with strategies, actions, and projects; areas where a state agency or other agencies may be able to assist in funding, communication, cooperation, or implementation of IRWMP components or processes; or where state or federal regulatory decisions and approvals are required for implementation. A number of state and federal agencies are currently involved in various aspects of water management in the IRWMP Region and surrounding areas. This section discusses the state agencies and their potential influence on the IRWMP development and implementation. The state and federal agencies have a wide range of jurisdictional authority and responsibilities assigned by law that can help or influence the IRWMP.

3.3.12 Department of Water Resources

DWR has been a partner in the IRWMP planning process from the beginning and has provided technical and financial support to the IRWMA and KRCD. DWR operates and maintains the State Water Project (SWP), including the California Aqueduct; provides

dam safety and flood control services; assists local water districts like KRCD in water management and conservation activities; promotes recreational opportunities; and plans for future statewide water needs. DWR, which is not a regulatory agency, has historically provided both grant and loan funding to local agencies to plan and build water supply projects and implement groundwater programs. Proposition 84 is the most recent program with the guidelines, standards, and process used to evaluate projects and distribute funds to local agencies. DWR also establishes standards and guidelines and provides support for Urban Water Management Plans (UWMP) and Groundwater Management Plans (GWMP). There has been an increased emphasis on groundwater planning and development of conjunctive use programs throughout the state.

3.3.13 State Water Resources Control Board/Regional Water Quality Control Boards

The CWC defines the roles and responsibilities of the SWRCB and the nine RWQCBs. The SWRCB administers surface water rights, water pollution control, and water quality functions throughout the state, while the nine RWQCBs conduct planning related to water quality, permitting, and enforcement activities. The SWRCB sets statewide policy and, together with the RWQCBs, implements state and federal laws and regulations. Federal water quality requirements are managed by the SWRCB under the Porter-Cologne Water Quality Control Act (CWC §13000). The SWRCB does not have the authority for managing groundwater or determining groundwater rights. The SWRCB distributes and manages a range of grant- and loan-funded programs, including the Clean Water State Revolving Loan fund to build wastewater facilities, and grants for watershed management programs.

Both the Kings River and the San Joaquin River have been determined to be fully appropriated by the SWRCB (Decision 1290). This means that there is no water on the Kings River that could be assigned a new water rights permit (CWC §§ 1205–1207). Minor potential sources of surface water may still be subject to appropriation through water impounded by flood control detention facilities built on the Fresno Stream Group, Mill Creek, or the Arroyo Pasajero Stream Group on the west side of the San Joaquin Valley. A water rights application has been filed for potential impounded water on the Fresno Stream Group for purposes of groundwater recharge by FID, the Cities of Fresno and Clovis, and FMFCD.

The IRWMP Region is covered by the Central Valley Water Quality Control Plan — Tulare Lake Basin (Basin Plan), last revised in January 2004 (RWQCB, 2004). The Basin Plan establishes the water quality objectives and standards for the IRWMP Region and the policies and programs of the RWQCB to ensure that water quality is protected and meets all of the designated beneficial uses. The Basin Plan is expected to be updated in 2013 or 2014. The Authority is coordinating efforts with CV-SALTS.

3.3.14 Department of Fish and Game

The mission of the California Department of Fish and Game (DFG) is to manage California's diverse fish, wildlife, and plant resources, as well as the habitats upon which

they depend, for their ecological values and for their use and enjoyment by the public. In 2006, DFG identified seven strategic initiatives that signify the continual evolution of DFG and its direction. The Initiatives include:

- Initiative 1: Enhance communications, education and outreach
- Initiative 2: Develop statewide land stewardship based upon resources needs including acquisitions, enhancements and management
- Initiative 3: Develop strong water resource management program
- Initiative 4: Develop and enhance partnerships
- Initiative 5: Improve regulatory and permitting programs
- Initiative 6: Enhance organizational vitality by focusing on employees and internal systems
- Initiative 7: Expand scientific capacity

DFG has both planning and regulatory functions and is responsible for protection and enhancement of public trust resources, like the Kings River. For planning purposes, DFG is a partner with KRCD and KRWA to plan and develop the Kings River fisheries management program. DFG also supports development of habitat conservation plans and strategies for upland, aquatic, and riparian habitats, so it can serve as a resource in these areas. DFG regulatory functions that could influence the implementation of the IRWMP are related to the California Endangered Species Act and to environmental review and permitting of potential projects. State law requires any person, state or local governmental agency, or public utility to notify DFG before beginning an activity that will substantially modify a river, stream, or lake. DFG will determine if the activity could have a substantial, adverse effect on an existing fish and wildlife resource and whether a Lake or Streambed Alteration Agreement is required.

3.3.15 State Water Resources Control Board, Division of Drinking Water

The State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW) permits municipal drinking water systems, regulates contaminant sources, establishes and enforces regulations for the use of reclaimed wastewater, and runs a range of other programs to protect water quality and public health and safety. The DDW also possesses extensive data on water quality for existing systems in the IRWMP Region.

The DDW is the lead agency for developing and implementing the Drinking Water Source Assessment and Protection (DWSAP) Program. The drinking water source assessment is the first step in the development of a complete drinking water source protection program. The assessment includes a delineation of the area around a drinking water source through which contaminants might move and reach the drinking water supply; an inventory of Possible Contaminating Activities (PCA) that might lead to the release of microbiological or chemical contaminants within the delineated area; and a determination of the PCAs to which the drinking water source is most vulnerable. Assessments have been conducted for water systems in the IRWMP Region. The SWRCB sets Maximum Contaminant Levels (MCL) for trace elements, different types of organic contaminants,

microbial (biological) contaminants, trihalomethanes, and many other potential contaminants to ensure that the water is safe for human consumption.

The SWRCB will be concerned about IRWMP goals for protection of water quality and any IRWMP projects that may negatively impact municipal and domestic beneficial uses. The DDW has produced statutes and regulations related to reuse of disinfected tertiary recycled water and works with the RWQCBs to ensure protection of water quality and to review projects that propose to make use of reclaimed water. Any IRWMP projects that include delivery and treatment of surface water would need to meet Title 22 standards. At a minimum, water designated for municipal uses cannot contain concentrations of chemical constituents that exceed the MCLs specified in Title 22 of the California Code of Regulations, which are incorporated by reference into the water quality objectives for groundwater in the RWQCB Basin Plan.

The DDW distributes and manages a range of grant and loan programs, including the Drinking Water State Revolving Fund, Proposition 1 and Proposition 84 programs to fund necessary drinking water facilities.

3.3.16 U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (Corps) operates and maintains Pine Flat Dam and Reservoir, administers recreation facilities around the reservoir, and is in charge of all matters related to flood control, including flood releases. The Corps has important flood control and floodplain management responsibilities in areas with federal levies. The Corps is also responsible for the Clean Water Act 404 permits in situations where waters of the United States may be impacted by projects such as those that may be developed under the IRWMP.

In 1993, the Corps began a fish and wildlife habitat enhancement study for the Kings River and Pine Flat Reservoir. This resulted in a reconnaissance study that identified possible projects and led to a cost-sharing agreement between KRCD and the Corps in 1996 to further evaluate the feasibility of potential projects and develop the Pine Flat Dam Fish and Wildlife Habitat Restoration Feasibility Study. The earlier reconnaissance work identified the turbine bypass project that was subsequently built in 2002 and was funded in cooperation with KRCD. The turbine bypass project provides for flexible operations and allows for the release of cold water from the Reservoir to support the downstream fishery at times when the power plant is not in operation. Both efforts are part of the coordinated fisheries management program in cooperation with KRCD, KRWA, and DFG.

3.3.17 U.S. Bureau of Reclamation

The relationship between the US Bureau of Reclamation (USBR) and the local agencies in the IRWMP is limited because only a few agencies in the Kings Basin receive water from USBR (CVP water). Most receive water from the Kings River, which is not under USBR jurisdiction. The role of the USBR has been developed and modified by various laws since 1902. The Reclamation Reform Act determined that acreage limitation

provisions of USBR law did not apply to Corps projects even though they were repaid via USBR repayment contracts.

Reclamation is the owner and operator for most of the CVP. Local entities such as FWA operate many of the conveyance features of the CVP such as the Friant-Kern Canal. This includes the Friant Division on the San Joaquin River and all of the other facilities north of the IRWMP Region, including the East Side, San Luis, San Felipe, Delta, American River, Shasta/Trinity, and Sacramento River Divisions. All of the long-term CVP contracts have been subject to renewal and are in various stages of completion. Those without long-term contracts have been operating with interim contracts.

CVP facilities could be used to transfer or import water from other areas into the IRWMP Region. The IRWMP might evaluate using the CVP facilities to "wheel" or convey water obtained through agreement for transfer or exchange. Water from the CVP Friant Division is currently delivered under contract to entities in the IRWMP Region. Water diverted at the Delta is delivered down the DMC to contractors in the lower part of the Kings basin. These operations could be influenced by the CVPIA or other Reclamation programs on the San Joaquin River, including the Upper San Joaquin River Basin Storage Investigation and the San Joaquin River Riparian Habitat Restoration Program.

In 1992, Congress passed multipurpose water legislation containing 40 separate titles, providing for water resource projects throughout the West. Title 34, the CVPIA, significantly changed the way the CVP is operated by mandating changes in management, particularly for the protection, restoration and enhancement of fish and wildlife. Major areas of change include:

- 800,000 acre-feet of water dedicated to fish and wildlife annually;
- tiered water pricing applicable to new and renewed contracts;
- water transfers provision, including sale of water to users outside the CVP service area;
- special efforts to restore anadromous fish population by 2002;
- restoration fund financed by water and power users for habitat restoration and enhancement and water and land acquisitions;
- no new water contracts until fish and wildlife goals achieved;
- no contract renewals until completion of a Programmatic Environmental Impact Statement;
- terms of contracts reduced from 40 to 25 years with renewal at the discretion of the Secretary of the Interior;
- installation of the temperature control device at Shasta Dam;
- implementation of fish passage measures at Red Bluff Diversion Dam;
- firm water supplies for San Joaquin Valley wildlife refuges; and development of a plan to increase CVP yield

3.3.18 U.S. Fish and Wildlife Service, NOAA Fisheries

The U.S. Fish and Wildlife Service (FWS) is the federal agency that conducts a wide range of activities for conservation, habitat planning, and protection of endangered species. It is the primary federal agency charged with management and enforcement of the Federal Endangered Species Act (Federal ESA) as it applies to terrestrial and aquatic habitats. The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries Service) manages marine fishery resources, including inland waters that support anadromous species. This includes compliance with the Federal ESA for salmon, steelhead, and other anadromous species issues.

Within the IRWMP Region, the FWS or NOAA Fisheries will get involved if an action has effects on federally listed threatened and endangered species. This would include any action that involves use of federal facilities, permits, or funding. NOAA Fisheries would become involved if there is a potential impact to salmon or steelhead species. In their conservation role, the FWS manages habitat and refuges, such as the San Luis National Wildlife Refuge Complex west of the region near Los Banos. The FWS has also developed the San Joaquin Upland Species Recovery Plan which seeks to protect listed species in the San Joaquin Valley and preserve important habitat.

3.3.19 U.S. Department of Agriculture, Natural Resources Conservation Service

The NRCS works with local agencies and land owners and provides technical support for conservation of land and water, prevention of erosion, preservation or restoration of habitat, and other programs to help conserve resources. NRCS provides financial assistance for many conservation activities. Participation in NRCS programs is voluntary. Some NRCS programs, such as the Farm Bill, help farmers and ranchers resolve environmental issues on their land, enhance the long-term quality of the environment, and conserve natural resources. This includes technical support and funding programs, such as the Agricultural Management Assistance and Wetland Reserve programs. NRCS can make incentive payments to agricultural producers to voluntarily address issues and incorporate conservation practices into their farming operations. Producers may construct or improve water management structures or irrigation structures; plant trees for windbreaks or to improve water quality; and mitigate risk through production diversification or resource conservation practices, including soil erosion control, integrated pest management, or transition to organic farming. NRCS has also been active in helping dairies develop nutrient and conservation management plans.

3.4 Water Supply and Demand

The IRWMP Region includes a complicated network of facilities managed by the local water and land use agencies. This section discusses facilities, including water storage, water delivery, groundwater recharge, wastewater collection and treatment, flood control, and storm water management. The various systems and their capacities are described and their relationships to the IRWMP are discussed.

3.4.1 Water Supplies and Demands

Specific water supply and demand estimates are found in other IRWMP chapters and external documents. The potential impacts of climate change on water supplies and demands are discussed in Chapter 17. Water supplies and demands in the Kings Basin were evaluated by WRIME (*Analysis of Water Supplies in the Kings Basin* and *Baseline Conditions*).

3.4.2 Kings River Integrated Water Supply and Flood Control Facilities

The major water supply and flood control facilities are part of an integrated system that is managed to meet multiple objectives. Multiple districts and land use agencies (city and county) are involved in the operations of the water supply and flood control facilities within the IRWMP Region. The facilities have been uniquely designed and built over time to capture, conserve, and manage the available water flowing into the IRWMP Region.

The following discussion characterizes the major regional water supply and flood control systems within the IRWMP Region and describes the more localized facilities used to manage water. The Kings and San Joaquin Rivers flow westerly from the Sierra Nevada into the IRWMP Region. The San Joaquin and Kings River watersheds contribute recharge to the Kings Groundwater Basin. The Kings Groundwater Basin is designated by DWR (DWR, 2003a) and is a smaller sub-basin of the larger San Joaquin Basin Hydrologic Study Area. Three dams have been constructed to control flows on the San Joaquin and Kings Rivers. These dams are the Pine Flat Dam on the Kings River, and the Friant and Mendota Dams on the San Joaquin River. The upper watershed has a number of other dams that provide both hydroelectric and water storage benefits and are critical to the timing and availability of water to the region.

These major regional facilities, in combination with the more localized network of canals, recharge/retention ponds, and flood control reservoirs, provide the foundation for identifying water management opportunities to meet IRWMP Objectives. The CVP (Delta Mendota Canal; Friant Kern Canal) and SWP Aqueduct make up the backbone of the state and federal water distribution system in the San Joaquin Valley. CVP and SWP infrastructure could potentially be used to develop new sources of imported water (transfers or exchanges) for the IRWMP Region.

Both the San Joaquin and Kings Rivers are sources of supply and groundwater recharge to the IRWMP Region and are subject to significant variation in annual runoff resulting from annual changes in mountain precipitation. Reservoir storage has helped to regulate and make more efficient use of available water during dry years and to protect life and property in wet years. However, storage capacity is generally inadequate to accommodate runoff during very wet years and substantial flows are lost to the IRWMP Region due to flood releases. During winter and spring months, river systems in the IRWMP Region swell with heavy rainfall and snow melt runoff. To conserve water, reservoirs are used to store winter rains for use in the summer. These same storage

reservoirs are used for flood control as well as water supply storage which can cause conflicts when storage space is needed for flood protection.

In addition to the natural stream channels, a complex network of local and regional canals delivers conserved water in summer months for irrigation, groundwater recharge, and municipal purposes, and flood water in winter months for groundwater recharge. The AID, FID, and CID canals convey water supplies primarily to agricultural users, though FID also conveys water to surface water treatment plants in Fresno and Clovis for municipal purposes. In winter months, the same facilities are used to convey stormwater around and away from developed areas. In the developed urban areas, local storm drainage systems composed of street gutters, inlets, underground storm drains, retention ponds, pumping stations, and open channels are used to collect and control stormwater runoff and direct runoff to the AID, FID, CID canals for flood control purposes. Many of the stormwater retention ponds are multi-purpose and provide benefits to groundwater recharge and recreation. As an example, FID through an agreement with the City of Fresno, City of Clovis and FMFCD delivers surface water for groundwater recharge to several stormwater basins during the typical irrigation season.

3.4.3 Pine Flat Dam

Pine Flat Reservoir is a major water facility that regulates the flow in the Kings River. It is located approximately 10 miles to the east of the Kings Groundwater Basin in the Sierra Foothills. The dam was completed in 1954 primarily as a flood control project with water conservation storage benefits. It has a capacity to hold 1,000,000 AF of water.

The Pine Flat Dam is managed by three agencies through a cooperative agreement: (1) The Corps determine the flood releases and criteria, (2) KRWA manages the conservation storage, and (3) KRCD operates the hydropower plant.

The management of the surface water rights has evolved since KRWA's formation in 1927. From its inception, KRWA has coordinated operations to serve each of its 28 members and to manage the Kings River entitlements. In practice, releases, diversions, and flow management on the Kings River are carefully coordinated by KRWA. Under the direction of KRWA, the irrigation releases are made from the dam in accordance with the terms of the water rights licenses, the provisions of Decision 1290 set forth by the SWRCB, and a complex series of agreements and water entitlement schedules ("Blue Book Agreements"). Pine Flat Dam has established operating parameters that change throughout the year and are used to allocate storage and flood capacity. Management of the reservoir space is based on forecasts, expected runoff patterns, snow measurements, and expected fill dates. With a large volume available for snowmelt and a sufficient storage to runoff ratio, Pine Flat Dam operations normally avoid emergency spillage.

3.4.4 Other Upstream Kings Storage Facilities

Pacific Gas and Electric (PG&E) owns and operates storage facilities on the Kings River and its tributaries upstream of the Pine Flat Dam. These upstream storage facilities

(Courtright Lake and Wishon Dam) have a combined capacity of about 251,700 AF and are operated primarily for the production of electrical energy. The operation of these projects can affect the flow, timing, or availability of water in Pine Flat Reservoir.

Other storage reservoirs and power projects have been proposed on the Kings River, most notably at Rodgers Crossing on the Kings River and on Dinkey Creek, a tributary to the North Fork of the Kings River. Neither of the projects was developed because of funding issues. Two potential low elevation reservoirs that were previously identified include an off-stream storage site on Mill Creek in Wonder Valley and the Piedra Afterbay below Pine Flat. Neither of these facilities has been developed.

3.4.5 Kings River Diversions and Weirs

There are a number of weirs on the river used to divert and manage Kings River flows. The individual water districts have authority over the operations for the weirs and water delivery canals. In addition to these 10 major weirs, there are 20 minor weir facilities and a large number of pumps. The weirs control diversions into the specific canals of the various water districts or ditch companies.

During time of flood release and high flows, water diverted to the North Fork travels up the Fresno Slough and through the James Bypass. These flows only occur during the winter in wet years. Once this water flows north and reaches the San Joaquin River, there is no opportunity for further capture or conjunctive use in the Kings Groundwater Basin.

3.4.6 Canals, Delivery Facilities, and Recharge Ponds

There is an extensive canal network owned and operated by the irrigation and water district within the region. The canal network is used to convey water to users within those districts. The water is used directly for agricultural, groundwater recharge, irrigation and municipal purposes in the region.

The region has more than 1,200 miles of canals and pipelines to deliver water to agricultural lands and to existing recharge facilities. Many of those facilities were originally constructed in the late 1800s. The major canals that service the Kings Basin include the Fresno Canal, Gould Canal, Alta Canal, and Consolidated Canal.

3.4.7 Other San Joaquin Storage Facilities

Southern California Edison (SCE) and PG&E own and operate a number of dams and reservoirs on the San Joaquin River and its tributaries upstream of Friant Dam. The most notable of these are Bass Lake, Huntington Lake and Shaver Lake. These upstream storage facilities are operated for the production of electrical energy and have a combined capacity of about 609,530 AF. Their operation affects the flow of water into Millerton Lake and subsequently the timing and availability of releases to Friant Division Contractors. None of these storage facilities is designed or operated for flood control and the Corps

currently has no jurisdiction over releases from these structures. Inflow increases requiring flood releases from the upper San Joaquin River dams could result in uncontrolled releases from Friant Dam.

3.4.8 Federal and State Facilities

Regional facilities owned and operated by the federal and state governments could have an influence on the IRWMP. Potential sources of future supply could include importation, water transfers, or exchanges that make use of these facilities to convey water into the IRWMP Region.

3.4.9 Friant Division of the CVP

San Joaquin River flows are regulated by Friant Dam, which was constructed in 1942 and is managed by Reclamation as part of the Friant Division of the CVP. The CVP Friant Division consists of Friant Dam and Millerton Lake, the Friant-Kern Canal, which runs south to Kern County, and the Madera Canal, which runs northwesterly to Madera County. The Friant-Kern Canal conveys water into and through the IRWMP Region.

Releases from Friant Dam to the San Joaquin River and the Friant-Kern Canal provide surface water to users within Fresno County, including City of Fresno, Orange Cove Irrigation District, and the FID. There are no CVP contracts in the Tulare County portion of the IRWMP Region, which includes all of the AID service area.

The reservoir, Millerton Lake, has a storage capacity of about 520,300 AF. The storage capacity of Millerton Lake has been insufficient for flood protection in wet years causing emergency releases and downstream flooding problems. In 1997, releases exceeded downstream channel capacity which is supposed to be maintained at 8000 cubic feet per second (cfs). Inflow into Millerton was estimated at over 120,000 cfs and outflow peaked at 60,000 cfs. The Corps has evaluated the operational plans for all the dams in the San Joaquin River system to determine the possibility of coordinated releases to reduce the likelihood of coincident peak flows downstream. Nevertheless, with a large storm in 1997, the storage capacity of Millerton Lake was exceeded, and a short-term high peak flow occurred below Friant Dam and several levee breaks downstream contributed to flooding along the San Joaquin River.

The amount of capacity in Millerton Lake that Reclamation keeps available for runoff varies throughout the year according to defined operating criteria that have been developed and agreed to by federal agencies (e.g., Reclamation, Corps) and state agencies (most notably the DWR).

The Friant-Kern Canal carries irrigation water from Millerton Reservoir south to its terminus in Kern County. The Friant-Kern Canal was constructed by Reclamation and is now managed by the Friant Water Authority. The average annual delivery from the canal is about one million AF with a design capacity of 5,000 cfs at its head. There is a spillway into the Kings River just upstream of a double barrel 24-foot diameter siphon under the

river. This spillway can be used to deliver San Joaquin River water to the Kings River. At times when San Joaquin Flood water can be delivered, the Kings River can be in flood conditions as well. San Joaquin River high flows in excess of long-term contractor demands can be contracted for on a one-year temporary basis under Section 215 of Reclamation Law, thus the name 215 Water.

3.4.10 Mendota Dam

Mendota Dam is operated primarily for irrigation. The Dam was built to divert San Joaquin River water under riparian and pre-1914 rights held by predecessors to the Exchange Contractors. Mendota Pool is a 5,000 AF reservoir created by Mendota Dam located on the San Joaquin River just outside the City of Mendota. The primary functions of the dam are storage and diversion of irrigation water for agriculture, although the water level in the pool also functions to maintain water levels in the Mendota Wildlife Management Area. Mendota Pool provides little or no flood protection. Mendota Dam holds flows from the San Joaquin River as well as discharge and releases from the Kings River via the North Fork (Fresno Slough and James Bypass). The DMC conveys water from the Delta to Mendota Pool from the north. Several irrigation channels then divert the Delta flows to irrigation districts with CVP contracts. Reclamation, in coordination with the Central California Irrigation District, manages this system, which is part of the CVP. Reclamation has proposed replacing the existing structure with a new Mendota Dam, which may raise the water level in the pool.

3.4.11 CVP Exchange Contracts

Reclamation holds the majority of San Joaquin River water rights, which were acquired by Reclamation during the development/construction of the CVP Friant Division facilities. These water rights were obtained through purchase and exchange agreements with the individuals and entities that held those water rights at the time the Friant Division facilities were developed. Historically, San Joaquin River water was diverted by the downstream users at Mendota Pool and Sack Dam, who became exchange contractors. The exchange contractors receive water from the DMC in exchange for their San Joaquin water. San Joaquin River water is now delivered to the east side of San Joaquin Valley through the CVP Friant-Kern and Madera Canals to supplement groundwater pumping and help mitigate overdraft problems. Reclamation has obligations to deliver project water downstream of Friant Dam to Gravelly Ford through water rights settlement contracts.

Reclamation also provides an exchange supply for larger riparian water right holders farther downstream of Gravelly Ford. These water users are the Exchange Contractors including Central California Irrigation District, Firebaugh Canal Water District (formerly Firebaugh Canal Company), San Luis Canal Company, and Columbia Canal Company, which obtain their water supply from the Delta via the Delta-Mendota Canal and Mendota Pool.

If Reclamation is not able to meet its contractual obligations for water deliveries from the Delta, the exchange contract provides for releases from Friant Dam and delivery using the San Joaquin River. This could reduce water available for other CVP contractors in the IRWMP Region.

3.4.12 Regional and Local Flood Control and Storm Water Management

The large-scale flood control for the IRWMP Region is provided by Pine Flat Dam and Pine Flat Reservoir and to a lesser degree by Friant Dam and Millerton Lake. More localized flood control and storm water management facilities are operated by a mix of special districts and land use agencies.

3.4.13 Kings River Flood Control Facilities Operations and Maintenance

The Federal Flood Control Act of 1944 authorized the construction of Pine Flat Dam and also authorized certain channel improvements along the Kings River downstream from the dam. Federal law requires that a local agency assume sponsorship of the levee projects. At the urging of the irrigation districts in the area, the KRCD undertook the sponsorship of the channel improvements in 1959 and the waterways banks along the right and left of the Kings River were transferred to the KRCD for operation and maintenance in 1971. In total, the KRCD maintains more than 140 miles of levees. Under the general provisions of the flood control regulations, the KRCD is responsible for maintenance and operation of flood control works for structures and facilities during flood periods and for the continuous inspection and maintenance of the project works at other times.

The principle mission of the Corps during flood emergencies is to operate Pine Flat Dam, work with the KRCD to ensure that flood control works are properly operated and maintained and offer technical advice to enable local interests to obtain maximum flood protection.

Levee maintenance requires periodic inspections to ensure that maintenance measures are being effectively carried out. Such inspections are made immediately prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days and such intermediate times as are necessary to ensure the best possible care of the levees. Measures are taken to control erosion; exterminate burrowing animals; provide for removal of wild growth and drifts deposits; suppress or eradicate invasive plants and repair damage caused by erosion or other forces. In order to ensure that channel maintenance is accomplished in a manner which minimizes any adverse environmental impact, removal of healthy, large-diameter trees within the floodway is avoided where practical and vegetation is preserved as a part of selected clearing of the waterside berm, channel bank, or levee slope during normal maintenance operations. Semiannual reports are prepared for the Corps covering inspection of bridges, weirs, and structures within the designated floodway, maintenance, and operation of the protective works.

The Kings River Channel Improvement Project was designed by the Corps to protect the adjacent lands, railroads, highways, and towns from floods expected to occur less frequently than once in 100 years. Non-damaging flood flows are conveyed through the flood project to the Mendota Pool where they join flows from the San Joaquin River. In extreme flood years, when flood capacity to the San Joaquin River will be exceeded, damaging flood flows are then diverted to the Tulare Lake. Flood project works constructed on the Kings River generally consisted of channel and levee improvements needed to maintain the capacities defined in **Table 3-4**.

Table 3-4: Flood Capacities to Be Maintained on the Kings River

River Segment	Flood Capacity
Main Kings River	
Lemoore Weir to Island Weir	9,100 cfs
Island Weir to Crescent Weir	6,300 cfs
Kings River North (Fresno Slough)	4,750 cfs
Kings River South	3,200 cfs
Clarks Fork	2,500 cfs
Crescent Bypass	1,500 cfs

3.4.14 The Fresno Metropolitan Flood Control District and Fresno-Clovis Area

The FMFCD Service Plan, adopted in 2017, describes in detail the regional and local storm drainage and flood control facilities for the Fresno-Clovis metropolitan area (FMFCD, 2016). The Service Plan includes 163 adopted or proposed drainage areas, each providing service to approximately one to two square miles. All but five of the developed drainage areas are served by a retention or detention facility. Flood flows in the larger foothill streams of Big Dry Creek, Alluvial Drain, Pup Creek, Redbank Creek, and Fancher Creek are controlled by dams and detention basins constructed by the Corps of Engineers with FMFCD as the local sponsor and are known as the Redbank and Fancher Creeks Project. FMFCD has also constructed a second dam on Fancher Creek as a local project identified as the Fancher Creek Detention Basin. These facilities have largely eliminated the 100-year floodplain from the metropolitan area. These streams are collectively referred to as the Fresno County Stream Group.

Between the easterly boundary of the planned urban storm water drainage system and FMFCD's eastern boundary, there are approximately 175 miles of streams and channels, many of which are severely obstructed. FMFCD operates a rural streams program to preserve, restore, and maintain these channels, and to complete any additional facilities necessary to safely convey storm flows through the rural area and the downstream urban areas.

The local drainage program relates to the collection and safe disposal of storm water runoff generated within the urban and rural watersheds or "drainage areas." FMFCD local storm water drainage system consists of storm drains, detention and retention basins, and pump stations. Many of FMFCD's basins are also utilized for groundwater recharge.

3.4.15 Flood Control in the Incorporated Areas

Most of the incorporated cities in the IRWMP Region operate their own storm drainage and flood control system. The exceptions are the cities of Fresno and Clovis which are managed by FMFCD. Many cities also rely on the larger levee systems maintained by KRCD and the irrigation districts for flood protection. The irrigation district canals also move water around and away from the cities. The local storm drainage and flood control systems for the incorporated cities within the IRWMP Region are described below. The local storm drainage system for the Cities of Clovis and Fresno were described above.

3.4.16 San Joaquin River Flood Control Facilities and Operations

From Friant to Gravelly Ford, the San Joaquin River is part of the Designated Floodway Program administered by the State Reclamation Board. Land use restrictions and river management practices allow the river to meander, flood the overbank areas, and remain in a relatively natural state. Downstream of Gravelly Ford, the river is confined by levees. The design capacity of the San Joaquin River from Friant Dam to Chowchilla Bypass is in excess of 8,000 cfs while the channel capacity downstream is reduced. The major San Joaquin River flow constraint is the reach near Mendota and Firebaugh. Beyond that point, San Joaquin River channel capacity continues to decrease for some distance due to lack of annual flooding and natural channel clearing since Friant Dam was constructed. Further, downstream, the river channel has been deepened and widened by historic flows of the Merced River, Tuolumne River, and other tributaries.

3.4.17 Tulare County Unincorporated Areas

Tulare County has summarized existing information regarding Tulare County's drainage facilities, specifically identifying communities that lack storm drain facilities or rely only on surface drainage (Tulare County, 2004). Tulare County is the lead agency in providing storm drain infrastructure within the unincorporated areas of the county. Many of the unincorporated small communities have no underground drainage infrastructure, leaving only surface drainage which is more subject to flooding, and/or have infrastructure that is not properly functioning due to little or nonexistent facility maintenance. The County also recognizes that surface draining also poses a potential threat to wildlife, farm animals, and groundwater supplies, as there is limited ability to treat the water before it flows into a basin, or other surface waters such as a creek, irrigation ditch, or river. Storm water drainage infrastructure within unincorporated Tulare County is owned and managed by the Tulare County Resources Management Agency. Storm drain infrastructure improvements are generally constructed in conjunction with transportation improvement projects and site development projects.

The flood carrying capacity in rivers and streams has decreased as trees, vegetation, and structures have increased along the Kings River and other local drainage ways. Confined floodplains can result in significantly higher water elevations and higher flow rates during high runoff and flood events. Updated channel analyses have not been performed to determine the amount of obstruction posed by vegetation and development in the Kings River channels. As such, the background report acknowledges that the Federal Emergency Management Agency (FEMA) maps depicting the 100-year floodplain for the rivers probably do not reflect the true extent and risk of flooding hazards in Fresno, Kings, and Tulare counties. FEMA is currently updating the flood zone maps in California.

3.4.18 Domestic Water Service Providers and Systems

Domestic water service is provided by a wide mix of providers. Municipal utilities provide water to most of the larger cities with the exception of Selma, which is served by California Water Service Company. Historically, all of the cities relied on groundwater. As a result of overdraft and groundwater quality issues, the Cities of Clovis and Fresno constructed surface water treatment plants to increase their conjunctive use programs and make use of available surface supplies and entitlements. Unincorporated communities in Fresno and Tulare Counties are served by CSDs, CSAs, or PUDs and rely almost exclusively on groundwater. The capital facilities plans of the domestic service providers are critical to the water quality program element of the Kings Basin IRWMP.

Information on public water systems was obtained through review of the city and county general plans, local GWMPs, available water supply master plans or capital facility plans, and through contacts with Fresno and Tulare LAFCOs, CDPH, local public works departments, and County General Plans.

Areas of residential development exist throughout the unincorporated areas of the IRWMP Region. Domestic users in the areas of development concentration that are not served by public entities, rely on individual wells, or are provided water by small mutual water companies or private community water systems

3.4.19 Wastewater Collection, Treatment, Disposal

The capital facilities plans of the local wastewater treatment service providers are critical components of the water quality program element of the Kings Basin IRWMP. Wastewater collection, treatment, and disposal are regulated by the Central Valley RWQCB. Local government and special districts own and operate collection systems (sewers) and wastewater treatment plants. All of the entities that treat and discharge wastewater obtain permits from the RWQCB to discharge treated plant effluent and dispose of biosolids (sludge). Residents in rural areas that are not served by sewers most often use on-site septic systems. Industries are sometimes required to provide pretreatment of their waste prior to discharge to a publicly owned treatment works or they must obtain separate discharge permits from the RWQCB if they are operating independent facilities. The objective of such permits is to preserve surface and groundwater quality for beneficial use and to protect the public health. With the exception

of Reedley, which has an NPDES permit, none of the plants discharge directly to surface water.

In Fresno County, more than 70% of all discharges are classified as municipal, and are mostly domestic waste, and 90% of municipal flows are generated within corporate city limits. Similar statistics were not readily available for Tulare or Kings counties. Most non-municipal waste is derived from agricultural-related industries, primarily food processing and packing. Detailed information on wastewater treatment and disposal facilities for the incorporated and unincorporated areas is provided in the Baseline Conditions, Technical Memorandum (WRIME, 2006b).

3.4.20 Incorporated Cities

All incorporated cities within Fresno County and Tulare County are served by local wastewater collection and treatment facilities. The majority of treated wastewater is domestic (household type) waste with a small amount (estimated at 0–11% depending on the city) coming from industrial discharges. Most treatment plants provide secondary treatment, but some smaller cities still have only primary treatment facilities. Other cities in the county generally have adequate capacity for the foreseeable future. The Fresno County General Plan Background Report (Fresno County, 2000) provided a summary of treatment facilities and identified sources of available sewer collection system maps. A baseline conditions report has been produced by Tulare County as part of the general plan update program (Tulare County, 2004). There are no metropolitan areas in the Kings County part of the IRWMP Region.

3.4.21 Unincorporated Communities

Unincorporated communities use special districts to provide wastewater collection, treatment and disposal facilities. Fresno County owns and operates nine sewage and wastewater treatment facilities on behalf of water works districts (WWDs) and CSAs. Tulare County unincorporated areas are served by a number of districts as discussed below. The RWQCB actively encourages consolidation of services and increased reclamation of treated effluent as the most economical methods to achieve water quality objectives in the area.

Most treatment facilities currently use evaporation/percolation ponds for effluent disposal. The RWQCB recognizes this as a viable interim disposal solution, but remediation of treated effluent for irrigation purposes is preferred in order to reduce impacts to groundwater and salts accumulation. Nitrogen removal/reduction is now being required for new discharge permits issued by the RWQCB. To achieve the nitrogen removal reclamation goals communities must now operate more costly activated sludge treatment plants and/or dispose of reclaimed wastewater by application to specified crops through irrigation at agronomic rates.

Industries, mostly food processing plants, also treat wastewater treatment and discharge in unincorporated areas of the county. The RWQCB issues discharge permits to industrial facilities.

Many rural landowners use private on-site septic systems for wastewater treatment and disposal. Over the past few years, an average of approximately 500 permits for new individual septic systems have been issued annually in the unincorporated portions of Fresno County, though it is not known how many are issued specifically in the IRWMP Region. Similar information for Tulare County was not obtained.

Fresno County's Mandatory Sewer Connection Ordinance requires connection to public sewer systems, where they are available, precluding the issuance of permits for installation of individual septic systems in such cases. In areas where public systems become available where they did not previously exist, structures of individual septic systems must be connected to the public system within three years or sooner if the existing facilities pose a health risk. In the event that required connections are not made within the required three-year period, the County may cause such a connection to be made, with the cost of the connection assessed to the landowner.

Areas served by on-site septic systems have had problems with accumulation of nitrates in groundwater (e.g., the Calwa, Sunnyside, Figarden and Mayfair areas through the Fresno-Clovis Metropolitan Area); however, these problems have been ameliorated when these areas are connected to a sewer utility. Most areas that remain on septic continue negatively to impact groundwater quality.

3.4.22 Environmental Water Demand

In the Kings Basin, some water is dedicated to meeting environmental demands. In 1964, DFG set an instream flow requirement of 50 to 100 cfs below Pine Flat Dam to sustain fish and wildlife. However, this requirement is not restrictive for most of the year. The Kings River is not designated a Wild and Scenic River below Pine Flat Dam, so there is no water requirement for this purpose. During summer months, the large quantities of water that are released to meet agricultural demands are also used to cover the instream flow requirement. During the winter months, Mill Creek and Hughes Creek, tributaries to the Kings River below the Pine Flat Dam, naturally feed the Kings River to meet the instream flow requirement. There is also a small area of managed wetlands that require Kings River water; however, the demand for these wetlands is less than 10,000 AF per year. There is no Bay-Delta outflow requirement because, despite existing manmade conveyances, historically the Kings River water did not flow north to the San Joaquin River (KRCD, 1997).

Water dedicated to environmental uses cannot be put to use for other purposes in the location where the water is reserved; however, it may be put to other uses further downstream as mentioned in the above paragraph. Another example is the mainstream of the Kings River and the South and Middle forks above 1,590 feet elevation. These stretches of river are designated as Wild and Scenic Rivers. However, after flowing

through these sections of river the same water is then used to meet urban and agricultural demand once it reaches the valley.

There are ongoing fisheries studies in the Kings River, below Pine Flat Dam as part of the Kings River Fishery Management Program, described below. Preliminary results indicate that meeting fishery flow requirements and environmental demands associated with restoration in this area could be integrated with conjunctive use projects in the region to provide multiple benefits.

3.5 Reduced Dependence on the Sacramento-San Joaquin Delta Supply

The region does not depend heavily on water supplies from the Sacramento-San Joaquin Delta; however, the County of Fresno does have a contract for 3,000 AF that is delivered through a water exchange via Delta supplies. As the IRWMP goals and objectives are implemented and met, overall water demands will decline, thereby reducing overall dependence on Delta supplies. Additionally, if deliveries from the Delta are reduced, there are provisions in place to deliver those supplies to the Exchange Contractors through other sources, as described above.

3.6 Water Quality Conditions

This section briefly reviews current surface water and groundwater quality conditions, known problems, and surface water and groundwater quality management programs. The quality of the available surface water and groundwater supplies influences the ability to put the water to use. If the quality of the water is degraded beyond the ability to put the water to the intended use, overall supply is limited, or the cost for additional treatment is increased, the ability to put the water to its intended use by the intended user could be limited.

3.6.1 Surface Water Quality

The major surface water source for the IRWMP Region is the Kings River, which has high quality water due to its origin in the uplands of the Sierra Nevada Mountains. As it collects agricultural return flows in the Valley, the instream water quality gradually declines but is still considered of high quality. The water quality in the Kings River in its upper reaches is generally of high quality.

The lower Kings River from the Island Weir to the Stinson and Empire Weirs has elevated levels of salinity, molybdenum, and toxaphene, as listed in the Clean Water Act 303(d) list maintained by the SWRCB. The SWRCB gives the reach a low priority for the development of a TMDL.

The Kings Basin is covered by the Water Quality Control Plan for the Tulare Lake Basin, Second Edition (Central Valley RWQCB 2016) (Basin Plan). The Basin Plan addresses the surface water quality issues of the Kings River, indicated by the listing on the 303(d) list, stating that the likely sources of the contaminants are either surface or subsurface

agricultural drainage and declaring that additional on-farm management practices may be necessary as the levels of boron, molybdenum, sulfates, and chlorides become high enough to affect agricultural uses and aquatic resources. A number of Best Management Practices (BMPs) have been recommended. The Basin Plan also recommends a surface water monitoring network selected from existing DWR monitoring points. Samples will be taken to monitor for the mineral character of the stream, occurrence of toxic substances, general levels of nutrients and biological responses, and common physical characteristics. In addition, the Basin Plan calls for continued monthly monitoring by KRCD of the Kings River for salinity, pH, and temperature; continued monitoring by RWQCB for constituents and areas of special concern; and monitoring by RWQCB of storm discharges from Naval Air Station Lemoore for hydrocarbons.

The U.S. Geological Survey (USGS) has done water quality work in the San Joaquin–Tulare Basins through the National Water Quality Assessment (NAWQA) program. The bulk of readily available data has been concentrated in the San Joaquin River and in the areas closer to the Sacramento–San Joaquin Delta; there are few data points for the Kings Basin. Other available USGS information was collected during studies to describe water quality associated with various land uses, rather than identifying local or regional water quality trends and conditions. There is some USGS information on surface water quality, including a bed sediment and tissue sampling event in 1992. Results of bed sediment sampling in 1992 showed levels below detection limits for 16 organochlorine pesticides in the Kings River bed sediments; samples were collected below Pine Flat Dam and below Empire Weir 2 near Stratford. Three sites in the Kings Basin were sampled for 14 organochlorine pesticides in tissue of fish below Pine Flat Dam, at Peoples Weir near Kingsburg, and below Empire Weir 2 near Stratford. Detections were made for dichlorodiphenyldichloroethane (P, P'-DDD) (6µg/kg below Empire Weir 2 near Stratford) and dichlorodiphenyldichloroethylene (P, P'-DDE) (16 µg/kg at Peoples Weir near Kingsburg and 95 µg/kg below Empire Weir 2 near Stratford); all other locations showed no detections (WRIME, 2005b).

For nearly two decades, growers in California operated under a conditional waiver that allowed for discharge of agricultural return flow and storm water runoff from agricultural lands (among others) without the issuance of a waste discharge requirement. In 1999, SB 390 was adopted and resulted in the sunset of all waivers on January 1, 2003. Since the passage of SB 390, the RWQCB has adopted conditional waivers as an interim step in an evolving irrigated lands program. The interim wavers are focused on building the capacity of local groups, engaging with individual dischargers, and starting data collection, all of which will be part of the foundation for the longer-term program.

As a result, growers have been organizing into groups such as the SSJVWQC, which represents growers in KRCD, KRWA, and other water districts to the south. The mission of the SSJVWQC is to develop plans and implement practices that address water quality issues and concerns affecting the Tulare Lake Basin as part of the agricultural waste discharge permit waiver program. The SSJVWQC participating agencies believe that they will be better served approaching these and other water quality issues on a regional

basis rather than individually and will implement monitoring plans to detect problems and management plans should problems be identified.

3.6.2 Groundwater Quality

The Kings River drainage area is predominantly underlain by granitic rocks. Therefore, the water from the drainage area is of the following types: calcium sodium; sodium calcium; and calcium bicarbonate type, the last one being the predominant type. The same type of water is also typically seen in the groundwater system. Groundwater adjacent to both perennial and intermittent streams generally is similar in chemical type to that in the streams. Adjacent to intermittent streams, dissolved solids content in groundwater generally is lower than that in surface water, but near perennial streams, it is usually higher than that in surface water. As groundwater in the area moves down gradient from areas of recharge, it exchanges some of its calcium and magnesium with sodium on exchange positions of clay minerals and thus increases slightly in sodium content. In the central western and southwestern parts of the study area, where sodium bicarbonate water occurs, there is an increase in percent sodium. In the northwestern part of the study area near the valley trough, groundwater is sodium chloride type.

Approximately 95% of the groundwater in the IRWMP Region is bicarbonate type containing calcium, magnesium, or sodium as the predominant cation. The average Total Dissolved Solids (TDS) concentration is 520 parts per million (ppm). Concentrations can exceed 2,000ppm as aquifer depth increases, depending on geological conditions in the area. Aside from pesticide and nitrate concerns in some areas, the groundwater is well suited for drinking.

3.6.2.1 Organic Constituents

Within the San Joaquin Valley, the most widely detected pesticide in groundwater is the nematodecide, dibromochloropropane (DBCP) (Domagalski, 1997). DBCP, which has not been allowed for crop application since the late 1970s, was applied primarily to vineyards and stone fruit orchards, and is still widely detected throughout the study area. Triazine and other organonitrogen herbicides are commonly detected in groundwater when DBCP is found. In general, pesticides in groundwater of the east side of the valley are more prevalent than in groundwater of the west side of the valley, due to soil characteristics being more suitable to infiltration on the east side of the valley (Domagalski, 1997).

Although DBCP is the most commonly detected pesticide, other detected pesticides and herbicides include: atrazine; bromacil; 2, 4-DP; diazinon; 1, 2-dibromoethane; dicamba; 1, 2-DCP; diuron; prometon; prometryn; propazine; and simazine. With the exception of diazinon, all these pesticides are applied directly to the soil, not to vegetation. Pesticide concentrations found in the study area rarely exceed drinking water standards, with the exception of DBCP.

The state recently established a new MCL for the compound 1,2,3-trichlorpopane (1,2,3-TCP; TCP), which became effective on December 14, 2017. The presence of TCP is

associated with use of a cleaning and degreasing solvent and has also been associated with various pesticide products. Detections of TCP in drinking water supplies has been increasing since about 2001, largely due to improved low detection analytical methods. Based on State monitoring data, the presence of TCP in groundwater is largely seen to occur in the Central Valley and the Los Angeles basin.

Pesticide residues in groundwater can be attributed largely to soil properties, chemical or physical properties of the pesticides, types of pesticides used, land use or cropping pattern, and depth to groundwater. Most groundwater pesticide residues are detected on the east side of the valley. These residues were attributed to sandy or coarse-grained soils of Sierra Nevada provenance, a relatively shallow groundwater table in some subareas, and the use of water soluble pesticides with long environmental half-lives (Domalgalski, 1993). Pesticide residues may not be as prevalent within some portions of the KBWA geologic conditions include more fine grain material. The lack of detections in the west side of the valley is attributable to long residence time of pesticides in fine-grained sediments of the unsaturated zone and the slow velocity of water recharge. The long residence time allows for degradation reactions to take place.

3.6.2.2 Radiological Constituents

Uranium is a naturally occurring, inherently radioactive, element. One possible way for it to contaminate groundwater is for it to be leached into the water supply from the aquifer rock formations. Most occurrences of uranium have been detected in the central and southern portions of the region, specifically in the small communities of Kerman, Raisin City, Hardwick, Easton, Monson and Yettem, and has occasionally exceed the State MCL of 20 µg/L.

3.6.2.3 Inorganic Constituents

In 2014, the California Legislature signed into law, Assembly Bill No. 1249 (AB1249), “an act to amend Section 10541 of, and to add Sections 10544.5 and 10545 to, the Water Code, relating to water quality”. A component of AB1249 requires IRWMPs to include the following discussions as they relate to nitrate, arsenic, perchlorate, or hexavalent chromium (Cr6) contamination within the IRWM boundary.

- The location and extent of that contamination in the region;
- The impact caused by the contamination to communities within the region;
- Existing efforts being undertaken in the region to address the impacts; and
- Any additional efforts needed to address the impacts.

3.6.2.3.1 Location and Extent of Contamination

The location and extent of contamination for each of the four constituents specified in AB1249 was derived from sampling data obtained from the Division of Drinking Water, Groundwater Monitoring Ambient & Assessment Program and Environmental Defense Fund. This data set encompasses water supply wells as well as environmental monitoring wells. Sampling results for each contaminant of concern is shown in **Figure 3-4**. The

sources of each of the constituents listed below are varied and not discussed in this report.

Nitrate

The Maximum Contaminant Level (MCL) for Nitrate as Nitrogen is 10 milligrams per liter (mg/L). Nitrate concentrations in study area groundwater have exceeded drinking water standards in some instances. Sampling data from 2016-17 indicates 676 samples exceeded the MCL out of 6268 total samples taken; equating to approximately 11%. Within this same data set, 2156 samples were between 5 and 10 mg/L or approximately 34%. These samples are scattered across the region, in both incorporated and unincorporated residential communities as well as agricultural areas.

Arsenic

The MCL for Arsenic is 0.010 milligrams per liter (mg/L) or 10 micrograms per liter (µg/L). Arsenic sampling data from 2016-17 indicates 387 samples exceeded the MCL out of 1470 total samples taken; equating to approximately 26%. Within this same data set, 165 samples were between 5 and 10 µg/L or approximately 11%. The areas with higher concentrations are concentrated in the western and southern portions of the region.

Perchlorate

The MCL for Perchlorate is 0.006 mg/L or 6 µg/L. Percholate sampling data from 2016-17 indicates 19 samples exceeded the MCL out of 635 total samples taken; equating to approximately 3%. These samples are located primarily in one area, in the eastern portion of the basin and are from three wells in the communities of Exeter, Dinuba and Lindsay. Perchlorate is not a widespread contaminant in the region.

Hexavalent Chromium

The MCL for Cr6, previously established at 0.010 milligrams per liter (mg/L) or 10 micrograms per liter (µg/L) has since been reversed. Presently Cr6 does not have an MCL; however, there are 53 samples out of 488 total samples taken exceeding the previously established MCL; equating to approximately 11%. The Cr6 occurrences within the IRWM are primarily near the City of Kerman with a few in the City of Fresno area.

3.6.2.3.2 Impacts Caused by Contamination

Nitrate

According to the Agency for Toxic Substances and Disease Registry (ATSDR), nitrate exposure in humans can be caused by ingesting drinking water or food contaminated with nitrate or use of some medications.

According to the Center for Disease Control (CDC), the impacts caused by nitrate exposure include acute toxicity resulting from the natural conversion of nitrate to nitrite during digestion which inhibits the oxygen-carrying abilities of the blood, a condition known as methemoglobinemia (colloquially referred to as “blue baby syndrome”). Risks

associated with drinking nitrate-contaminated water affect infants and pregnant women at greater frequency than other segments of the population.

Arsenic

As stated by the ATSDR, exposure to arsenic can be caused by physical contact with air or soil or ingestion of water or food contaminated with arsenic. Arsenic is a naturally occurring compound that does not deteriorate.

The CDC states the impacts caused by arsenic exposure include acute and chronic toxicity; however, acute responses are generally infrequent in the region. Long-term exposure can have both cancerous and non-cancerous effects. Cancers associated with arsenic exposure include cancers of the skin, bladder, lung, kidney, nasal passage, liver and prostate. Non-cancerous effects are linked with cardiovascular, pulmonary, immunological, neurological and endocrine disorders or diseases. The impacts affect all portions of the population.

Perchlorate

The ATSDR indicates perchlorate exposure can be caused by ingesting food or water that contain perchlorate. Perchlorate can be found naturally in the environment; however, it is most often introduced by humans in some way.

The CDC lists the impacts attributed to exposure to perchlorate include disruption to the thyroid gland, which in turn can cause irregularity in heart rate, blood pressure, body temperature, and metabolism. In unborn children and infants, the thyroid hormone is critical for development of the central nervous system; improper development of this vital system can have life-long effects. These types of impacts have been seen only rarely in the region, given the low occurrence of the constituent in drinking water supplies.

Hexavalent Chromium

According to the ATSDR, a majority of the hexavalent chromium (Cr6) found in the environment is caused by man-made releases either into the air or onto soil, both of which can affect groundwater quality. Human exposure is most often caused by ingesting water contaminated by Cr6.

According to the CDC, the impacts of Cr6 exposure can be grouped into short and long-term categories. The short-term exposure can cause eye and respiratory irritation, asthma attacks, ulcers, skin irritation, anemia, gastroenteritis, convulsions and damage or failure of liver and kidneys. The long-term risks affect reproductive ability and cancer risk. Long-term exposure to Cr6 can lead to reproductive challenges and cancer. While most impacts were once connected with inhalation of Cr6, more recent data shows a causal link with drinking water ingestion, also.

3.6.2.3.3 Existing Efforts to Address Contamination

The Members and Interested Parties of the Integrated Regional Water Management Group (IRWMG) have been consistent and proactive in their treatment and remediation of nitrate and arsenic in the region's groundwater. The incidence of perchlorate contamination has been low enough to not have resulted in any projects to mitigate its existence and the Cr6 focus has been fairly recent, thus not yielding any projects either. The introduction of an MCL for Cr6 in 2014 brought additional emphasis on identifying the locations of Cr6 occurrence and development of treatment or remediation methods. Methods for mitigating Cr6 in the drinking water supplies include avoidance, utilizing treated surface water, or treatment technologies being investigated, such as, ion exchange, reduction/coagulation/filtration, and adsorptive media. Research is still ongoing to evaluate existing and developing treatment technologies to determine the most cost-effective methods.

While there are no projects constructed, in the region, to date, a pilot study has been undertaken in Kerman to identify potential treatment methods that are both efficient and cost-effective. While the reversal of the MCL has removed some of the urgency regarding Cr6, the SWRCB has indicated a new MCL will be implemented in the next 2-5 years and funding is still available to address this constituent. **Table 3-5** shows the projects completed in the past ten years by the KBWA agencies addressing these constituents. Typical mitigation strategies are discussed in the following subsections.

Nitrate

Long-term methods for mitigating nitrate in drinking water supplies include avoidance, blending, utilizing treated surface water, or treatment technologies, such as ion exchange, reverse osmosis, and electrodialysis reversal. Avoidance in groundwater supply wells is achieved by pilot hole zone sampling prior to well construction, by installing a permanent seal after well construction over the perforated well casing adjacent to the water bearing formation impacted by nitrates. A short-term method for mitigating nitrate in drinking water involves installing point-of-use or point-of-entry treatment devices at each residences or potable water connection; this method is typically applied in smaller communities.

Blending involves combining a water supply with no or low nitrate contamination with a water with high nitrate contamination to achieve a blended water supply that meets drinking water standards. While blending is the most common approach in the region for nitrate mitigation, treatment technologies used regionally include ion exchange and reverse osmosis (RO). Ion Exchange results in brine waste that must be disposed of and is ineffective in water supplies with high sulfate levels. Reverse osmosis also produces a waste stream that must be properly disposed of and is susceptible to scaling when elevated concentrations of silica are in the source water.

Arsenic

Long-term methods for mitigating arsenic in the drinking water supplies include avoidance, blending, utilizing treated surface water, or treatment technologies, such as

ion exchange, activated alumina, reverse osmosis, enhanced lime softening, and enhance coagulation/filtration. Avoidance in groundwater supply wells is achieved by the same means as described above for nitrates and is the most common method of mitigating arsenic in regional drinking water supplies. Regionally, the most prevalent treatment technologies used for arsenic removal include adsorption (e.g. proprietary media systems), and coagulation/filtration. A short-term method for mitigating arsenic in drinking water involves installing point-of-use or point-of-entry treatment devices at each residences or potable water connection; this method is typically applied in smaller communities.

Perchlorate

Methods for mitigating perchlorate in drinking water supplies include avoidance, utilizing treated surface water, and treatment technologies, such as ion exchange, bioreactors, liquid phase carbon adsorption, reverse osmosis, and electrodialysis. Avoidance in groundwater supply wells is achieved by the same means as described above for nitrates.

Hexavalent Chromium

The introduction of an MCL for Cr6 in 2014 brought additional emphasis on identifying the locations of Cr6 occurrence and development of treatment or remediation methods. Methods for mitigating Cr6 in the drinking water supplies include avoidance, utilizing treated surface water, or treatment technologies being investigated, such as, ion exchange, reduction/coagulation/filtration, and adsorptive media. Research is still ongoing to evaluate existing and new developing treatment technologies to determine the most cost-effective methods.

While there are no projects constructed to date in the region, a pilot study has been undertaken in Kerman to identify potential treatment methods that are both efficient and cost- effective. While the reversal of the MCL has removed some of the urgency regarding Cr6, the SWRCB has indicated a new MCL will be implemented in the next 2-5 years and funding is still available to address this constituent.

Table 3-5: Existing Region-Wide Water Treatment Projects

Agency	Project Name	Year Completed	Project Goal
Armona CSD	Arsenic Reduction Well and Treatment Plant	2017	Provide safer drinking water through treatment for arsenic in groundwater supplies.
Bakman Water Company	Water Supply Reliability and Conservation Project	2018	Provide safer drinking water through installing ion exchange treatment for nitrate removal. Extraction of nitrate contaminated ground water and treating helps reduce the overall quantity of nitrate in the aquifer.

Agency	Project Name	Year Completed	Project Goal
Clovis, City of	Surface Water Treatment Plant	2004	Provide safe drinking water through use of treated surface water supplies to avoid use of contaminated groundwater supplies.
Fresno, City of	Surface Water Treatment Plant (Northeast and Southeast Plants)	Varies	Provide safe drinking water through use of treated surface water supplies to avoid use of contaminated groundwater supplies.
Fresno, City of	Nitrate Treatment (Blending)	Varies	Provide safe drinking water through blending water supplies in excess of the nitrate MCL with high quality water supplies; the City employs this method on six (6) active wells and three (3) inactive wells. Extraction of nitrate contaminated ground water and treating helps reduce the overall quantity of nitrate in the aquifer.
Lanare CSD	Well and Distribution Replacement Project	2019*	Provide safe drinking water through constructing two new wells to avoid arsenic contamination.
Malaga CWD	Nitrate Reduction Project	2019*	Reduce potential nitrate contamination contribution to the groundwater through reducing the amount of Nitrate in the wastewater effluent.
Monson (Tulare County)	Water System Project	2017	Provide safe drinking water through constructing a new well to avoid nitrate contamination and replace dry wells.
Riverdale PUD	Well 7 Improvements	2017	Provide safer drinking water through constructing a new well at 1800 feet depth to avoid aquifers with arsenic.

* Projected Completion Date

3.6.2.3.4 Additional Efforts Needed to Address Contamination

The members and interested parties in the region will continue to employ wellhead and treatment to remove nitrate and arsenic from drinking water supplies, as they have done in the past. However, additional efforts to assist with remediation of these constituents can be employed on a case by case basis, including some of the following strategies:

- Provide sewering projects for un-sewered communities
  - Through providing sewer system improvements to communities on septic systems, this method aids with the reduction of nitrate in groundwater through removing a nitrate source.
- Construct surface water treatment plants in cities and communities solely reliant on groundwater supplies
  - Construction of a surface water treatment plant can provide safe drinking water that is not contaminated by the constituents discussed in AB1259.
- Construct groundwater recharge basins

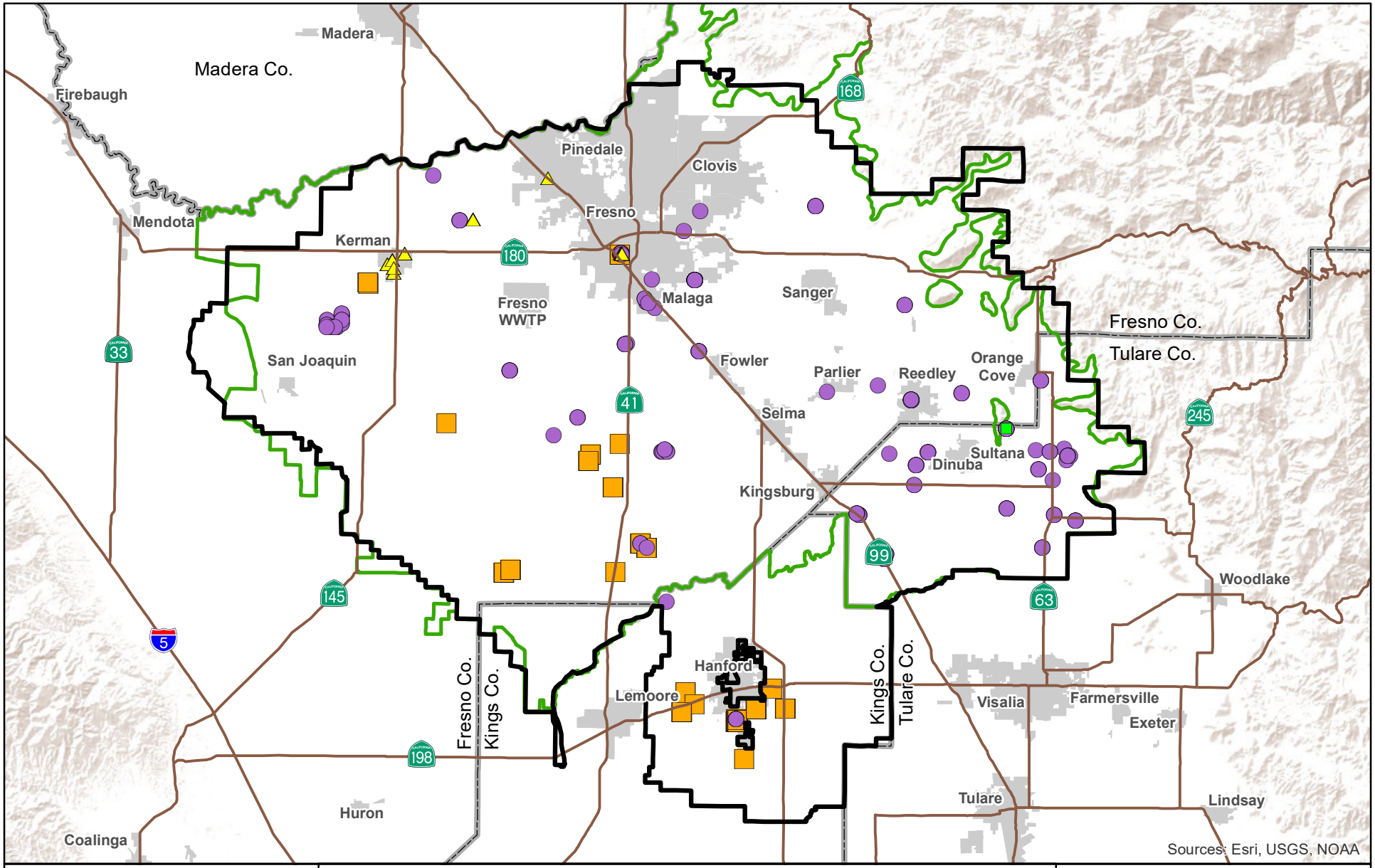
    - Construction of groundwater recharge basins with high quality water supplies, either through surface water or treated wastewater, provides dilution of the constituent. Increased groundwater recharge activities may dilute the constituent(s) to a level below the MCL and/or create a buffer to prevent contaminated resources from impacting otherwise pristine supplies.
- Contaminated aquifer avoidance
    - Through drilling water supply wells in deeper aquifers that are unaffected by various contaminants, the drinking water supplied to the public can meet drinking water standards.
- Nitrate application regulations
    - Through the implementation of nitrate-based fertilizer application regulations, the region's agricultural community aids in the reduction of nitrate in groundwater through removal of a nitrate source.
- Private well data
    - Private wells are largely unsampled and could provide a clearer understanding of the contamination extent of these constituents and the areas most impacted. When possible, Members and Interested Parties may undertake efforts to gather information on private well water quality from willing landowners and share the information with the Authority.

Implementation of a combination of the projects listed above can help with providing safe, reliable drinking water, and will also be utilized in compliance with ongoing and upcoming Sustainable Groundwater Management Act (SGMA) requirements.

Specific projects to be undertaken by the region have not been identified; however, several IRWM-participating agencies within the region have projects planned that will address these constituents (see **Tables 3.5** and **3.6**).

Table 3-6: Future Region-Wide Water Treatment Projects

Agency	Project Name	Year to be Completed	Project Goal
Easton CSD	Wastewater Treatment System	Unknown	Sewer approximately 200 homes currently relying on septic systems. Project is in preliminary planning stages.
Sultana CSD	Water System Improvements	2019	Provide safe and reliable drinking water through constructing a new well to avoid DBCP and nitrate contamination.
Various	North Tulare County Regional Surface Water Treatment Plan	Unknown	Provide high quality surface water, up to approximately 2500 acre-feet per year, to potentially seven communities and other rural residents relying on groundwater. Project is in the preliminary planning stages.



KINGS BASIN Water Authority

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Miles

- Kings Basin IRWMP
- City
- County
- Kings Groundwater Subbasin (CA DWR Bulletin 118)
- Perchlorate (MCL=6 UG/L)
- Chromium, Hexavalent (Cr6) (MCL=10 UG/L)
- Nitrate as N (MCL=10 MG/L)
- Arsenic (MCL=10 UG/L)

FIGURE 3-4

Kings Basin IRWMP

AB 1249 Constituents Regional Contamination (2016-17)

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3.7 Major Water Related Objectives and Conflicts

The Kings Basin IRWMP Region has many objectives and conflicts. Primary concerns include: Groundwater Overdraft, Water Supply Reliability, Degradation of Water Quality, Urban Development, Protection of Water Rights, Sustaining the Agricultural Economy, Protection of Life and Property from Flooding, Protection of the Environment, and Disadvantaged Communities. Each area of concern is discussed in further detail in Chapter 5 – Goals and Objectives. Chapter 6 – Resource Management Strategies describes applicable strategies for managing water supplies in the Kings Basin.

3.8 Regional IRWM Boundary

3.8.1 Ongoing Regional Partnerships

The Kings Basin IRWMP Region is defined with full recognition to the need for supporting and leveraging ongoing regional partnerships. In 2001, the KRCD, AID, CID, and FID signed an MOU with the DWR to coordinate data collection, field pilot studies, and water resources planning activities. The proposed IRWMP is synergistic with this MOU partnership due to common elements of planning. The IRWMP Region is larger than the region encompassed by this MOU partnership and includes other agencies within the physical and hydrological boundaries of the Kings Basin.

KRWA and KRCD, two key agencies involved with the IRWMP effort, are participating in the SSJVWQC, which was established in 2002. This partnership will facilitate the evaluation and analysis of both data and policy matters on water quality issues for the purposes of IRWMP development.

Stakeholders in the Kings Basin are preparing a coordinated implementation plan which will integrate monitoring and reporting efforts of the four major SB-1938 Groundwater Management Plans (GWMP) that overlay the Kings Basin. This coordinated effort will improve efficiencies and the consistency and accuracy of data, and annual reporting will better reflect the hydrogeologic and management conditions of the Kings Basin. A stakeholder-driven process, coordinated through a Lower Kings Basin Advisory Panel and consisting of water district and ditch company representatives, provided oversight to plan development. Stakeholders in the Upper Kings Basin participate in a similar process. There are other existing and more localized cooperative efforts within the Kings Basin, such as the McMullin Group and NFG. KRCD is supporting these groups and will coordinate the IRWMP effort with these groups as needed.

3.8.2 Potential for Achieving More Benefits by Operating as a Region

A key criterion for defining the IRWMP Region is the potential to achieve greater benefits by operating as a region. As mentioned before, the management of the water resources in the Kings Basin has been locally driven by overlying water agencies and individual water users. However, an overdraft problem in an expansive and interconnected groundwater basin cannot be effectively managed by local measures and actions taken

individually by overlying users. In addition, a comprehensive exploration of water resources management alternatives requires an integrated look at the entire watershed and groundwater basin beyond the jurisdictional boundaries of any single local agency. Since the defined IRWMP Region is hydrologically and physically interconnected, it is logical to conclude that there are multiple opportunities for achieving greater benefits by operating as a region.

3.8.3 Appropriateness of the IRWMP Region for Water Management

The Kings Basin region was approved by DWR through DWR's Regional Acceptance Process (RAP) in 2009. The geopolitical region defined for the Kings Basin IRWMP is appropriate for integrated water resources management for the following reasons:

- It is a large area served by multiple local agencies and stakeholders who share the same primary river and groundwater resources;
- The key water management drivers are the same or very similar throughout the region; these drivers include, but are not limited to, water rights, land use, development pressure, socio-economic and cultural makeup, groundwater overdraft, water quality problems, and regional goals;
- Because of size and diversity of the proposed region, all required components of the integrated water management strategies (IRWMP Guidelines by DWR) can be considered in the IRWMP;
- It includes the major water rights holders on the Kings River as willing partners in the process;
- It includes the cities which are facing development pressure and growth;
- It includes major irrigation districts and local agencies, who own and operate water facilities in the entire Kings Basin;
- The cooperative planning in the region will help reduce conflict between water users or resolve water rights disputes, an identified State priority;
- The region will be analyzed as a single hydrologic region with well-defined hydrologic boundaries for development of water budgets and analysis of project impacts;
- Surface and groundwater resources are already being actively monitored and managed by entities that cover the region, the KRCD and KRWA, with the proactive management by irrigation districts, municipalities and other entities. As a result, integrated regional planning is appropriate for optimizing the water resources across the region;
- The IRWMP boundary predominantly covers the Kings Groundwater Basin (see **Figure 3-1**); and
- The JPA satisfies the definition of a Regional Water Management Group provided in the CWC §10539 (see Chapter 2 – Governance).

Local, regional, state, and federal agencies that have relationships and potential roles in developing the IRWMP are listed in **Table 3-7**, which also compares the agencies' roles to the resource management strategies recommended by DWR. These strategies are discussed in detail in Chapter 6.

Table 3-7: Agencies and Roles Related to Resource Management Strategies

Organization	Roles Related to DWR Resource Management Strategies																							
	Agricultural lands stewardship	Agricultural water use efficiency	Conveyance (canals)	Drinking water treatment and distribution	Economic incentives (Loans, Grants, and Pricing)	Ecosystem restoration	Floodplain management	Groundwater storage / Conjunctive Use	Groundwater / Aquifer remediation	Matching water quality to water use	Pollution prevention	Precipitation enhancement	Recharge areas protection	Recycled municipal water	Surface storage – regional/local	System re-operation	Urban land use management	Urban runoff management	Urban water use efficiency	Water-dependent recreation	Watershed management	Water transfers	Wastewater treatment	Permit Requirements
Local																								
Special Districts																								
Alta Irrigation District		■	■		■	■		■		■					■	■		■				■		
Consolidated Irrigation District		■	■		■	■		■		■					■	■		■				■		
Fresno Irrigation District		■	■		■	■	■	■		■				■	■	■		■				■		
Kings River Conservation District		■			■	■	■	■		■	■	■	■		■	■					■			
Fresno Metropolitan Flood Control District			■		■	■	■	■					■		■		■	■			■			
Water Associations																								
Kings River Water Association															■	■						■		
Friant Water Users Association		■	■			■	■	■							■	■						■		
CSDs and PUDs				■										■			■	■	■				■	
Counties (Fresno, Kings, Tulare)																								
Public Works			■	■	■		■	■						■				■	■				■	
Planning	■				■	■	■										■							■
Health/Environmental Health				■	■				■		■			■									■	
Agricultural Commissioner											■													
Cities																								
Clovis				■	■			■			■		■	■	■		■	■	■				■	■
Fresno				■	■			■	■		■		■	■	■		■	■	■			■	■	■
Fowler				■	■						■						■	■	■					■
Kerman				■	■						■						■	■	■				■	■
Kingsburg				■	■						■						■	■	■					■
Parlier				■	■						■						■	■	■				■	■

Organization	Roles Related to DWR Resource Management Strategies																						
	Agricultural lands stewardship	Agricultural water use efficiency	Conveyance (canals)	Drinking water treatment and distribution	Economic incentives (Loans, Grants, and Pricing)	Ecosystem restoration	Floodplain management	Groundwater storage / Conjunctive Use	Groundwater / Aquifer remediation	Matching water quality to water use	Pollution prevention	Precipitation enhancement	Recharge areas protection	Recycled municipal water	Surface storage – regional/local	System re-operation	Urban land use management	Urban runoff management	Urban water use efficiency	Water-dependent recreation	Watershed management	Water transfers	Wastewater treatment	Permit Requirements
Reedley				■	■						■						■	■	■				■	■
Sanger				■	■						■						■	■	■				■	■
Selma				■	■						■						■	■	■					■
Dinuba				■	■	■					■			■			■	■	■				■	■
Other Regional: Selma-Kingsburg-Fowler Regional Sanitary District											■												■	
State																								
Department of Water Resources		■	■		■	■	■	■	■	■					■	■			■			■		
Regional Water Quality Control Board					■				■	■	■			■				■			■		■	■
State Water Resources Control Board		■		■	■	■			■	■	■			■	■						■	■	■	■
Department of Fish and Game					■	■														■	■			
California Department of Public Health				■					■	■	■		■	■									■	■
Department of Food and Agriculture	■				■						■													
Department of Pesticide Regulation									■		■													■
Department of Toxic Substances Control									■		■												■	■
California State University, Fresno	■	■																						
University of California Cooperative Extension – Fresno County	■	■																						
Federal																								
Corps of Engineers					■	■	■			■	■		■		■	■				■	■			■
Bureau of Reclamation		■	■		■	■		■		■					■	■				■		■		
Fish and Wildlife Services, NOAA Fisheries					■	■				■											■	■		■
Environmental Protection Agency					■	■				■	■			■				■			■		■	■
Department of Agriculture, NRCS	■	■			■	■					■										■			

3.9 Neighboring or Overlapping IRWM Regions

The IRWM region is bounded by the Westside-San Joaquin IRWM (west), the Kaweah River Basin IRWM (south), the Madera IRWM (north) and the Southern Sierra IRWM (east). The Kings Basin IRWMA region does not overlap its neighboring regions, as the various IRWM groups have made efforts to coordinate their boundaries as much as possible, as required by DWR. The Madera and Kaweah River Basin IRWMs are working through the process of updating their respective IRWMPs at this time. Coordination between IRWM regions is discussed more fully in Chapter 2 – Governance. **Figure 3-5** shows the IRWMP boundaries of the neighboring IRWMPs.

3.10 Climate Change Impacts

The impacts of climate change on the region are an important aspect for future planning in sustainable water use. An IRWMP vulnerability assessment was conducted (discussed in detail in Chapter 17), identifying several vulnerabilities for the region, including Backup Water Supplies, Inadequate Water Storage, Climate Sensitive Crops, and Flooding.

3.10.1 Backup Water Supplies

The region depends on both groundwater and surface water supplies to meet the demands. As climate change progresses, droughts are anticipated to become more frequent and more severe, resulting in decreased surface water supplies. The region relies on the groundwater as a backup supply; however, increased use of groundwater supplies is unsustainable and conservation opportunities will be explored to reduce the overall water demand in an effort to reduce this vulnerability.

3.10.2 Inadequate Water Storage

The water storage facilities have historically been adequate to contain season snow melts for use throughout the warm months. As temperatures rise, snow levels are anticipated to decline, and additional water storage may be needed to accommodate higher levels of rainfall in non-drought years. Use of recharge basins throughout the region will be considered to augment the existing water storage in lieu of building new reservoirs.

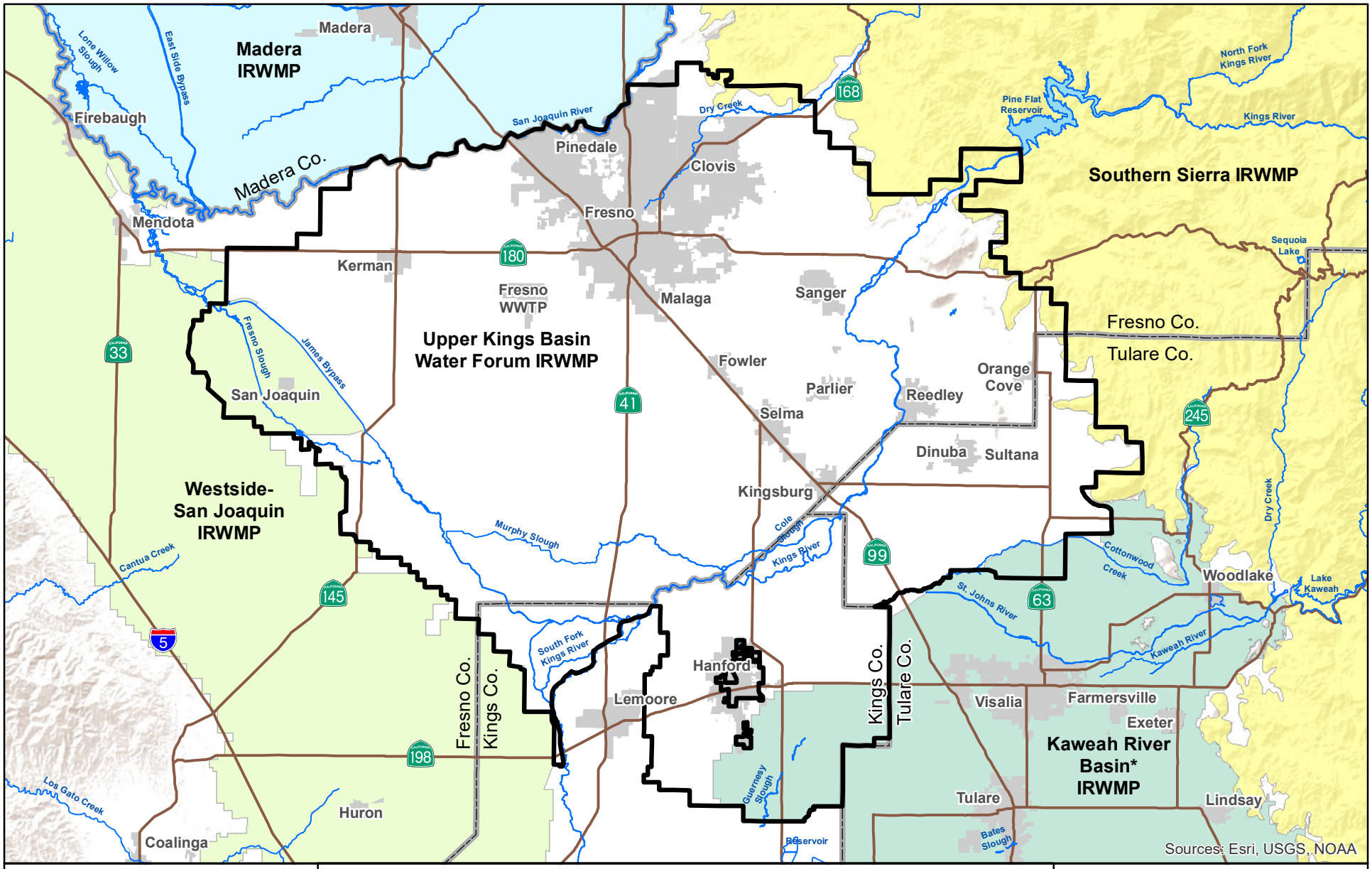
3.10.3 Climate Sensitive Crops

As temperatures rise, the frequency of winter freezes that benefits crops will decrease, potentially increasing the vulnerability of those crops. There are not project type mitigations possible for this vulnerability; however, there is a possibility of modifying the types of crops planted in some instances.

3.10.4 Flooding

Related to the inadequate water storage and rising temperatures, it is anticipated the quantity of runoff may increase or the timing will shift, requiring additional planning for

flood protection in currently vulnerable areas and nearby areas that will become vulnerable. Use of recharge basins to capture additional flood waters will be helpful.



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Miles

- Kings Basin IRWMP
- City
- County
- Kaweah River Basin IRWMP
- Madera IRWMP
- Southern Sierra IRWMP
- Westside-San Joaquin IRWMP

FIGURE 3-5

Kings Basin IRWMP

Neighboring IRWMPs

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4 DISADVANTAGED COMMUNITIES

4.1 Introduction

Disadvantaged communities (DACs), or economically disadvantaged communities, are prevalent in the Kings Basin and have many critical water supply and water quality needs. The purpose of this section is to identify the DACs in the Kings Basin and highlight their general needs. Specific topics that are discussed include:

- Important Cultural/Social Values of the Region
- Tribal Government Involvement and Collaboration
- Economic Conditions/Trends of the Region
- Disadvantaged Communities within the Region (DACs)
- Kings Basin DAC Pilot Study
- DAC Goals

4.2 Important Cultural/Social Values of the Region

The San Joaquin Valley of California is home to five of the top 10 counties in the nation in agricultural production. Fresno and Tulare Counties are ranked number one and two in this list. The Kings Basin Water Authority (Authority) region includes these two counties and a portion of Kings County, another predominantly agricultural area. The relatively less expensive land costs in the Central Valley and perpetual population growth in California is expected to make this region a leader in the growth rate over the next 20 years.

This growth will test an already challenged region that is home to many of California's poorest communities. Chronic high unemployment has plagued the counties in the region for more than three decades. Low per capita income and isolation from the economic engines of the San Francisco Bay Area and Los Angeles Basin have led to clusters of poverty in many of the counties in the San Joaquin Valley. According to the 2010 census, between 20% and 25% of those residing in the San Joaquin Valley counties were foreign-born compared to roughly 12.9% of U.S. residents. Language barriers are also prevalent in this region. More than 40% of the people in this region speak a language in their home that is other than English, compared to approximately 20% nationwide. Despite these challenges, the region is home to hard-working people, labor leaders, business leaders, and entrepreneurs who are collaborating to bring about change for the betterment of the region. Relevant social and economic data is presented below in **Table 4-1**.

Table 4-1: Socio-Economic Information on Counties in the IRWMP Region

	Fresno County	Tulare County	Kings County
Population 2010	930,450	442,179	152,982
Population 2016	963,160	455,769	150,261
Percent Population Growth	3.52%	3.07%	-1.78%
Median Household Income	$45,963	$42,789	$47,241
Median Age	31.6	30.4	31.4
% of Total Workers Employed in Agriculture	9.9%	18.5%	17.6%

Source: 2010 Census Data and 2012-2016 American Community Survey Estimates

4.3 Tribal Government Involvement and Collaboration

There are no Native American tribes located within the Kings Basin Integrated Regional Water Management (IRWM) area, therefore no involvement or collaboration was directly conducted. However, as discussed in Chapter 3, the Authority is in contact and cooperation with neighboring Integrated Regional Water Management (IRWM) regions. Overall, water management and planning efforts benefit the Kings Basin region and neighboring regions, which has a potential to affect the Native American tribes within the adjacent regions.

4.4 Economic Conditions/Trends of the Region

Economic development in the region requires a stable and reliable water supply of appropriate quality. Water supply reliability and water quality are critical to maintaining the local economy in three primary sectors: jobs creation, economic diversification, and housing. During the second half of the twentieth century, the region's economy was driven by agriculture and residential development. Despite the success of the agricultural economies and urban growth, the Region's unemployment rate remained among the highest in California and the average wage levels were low. During the first portion of the twenty-first century, the national recession raised unemployment rates and lowered average wage levels further. Economic development will require the water districts, counties, cities, private sector, and other organizations to create good jobs at a faster rate than population growth to bring the region in line with the rest of California in terms of employment rates and wage levels.

4.4.1 Jobs

The region's counties and cities are working to create jobs, expand and diversify the economic base, and prepare the labor force for the changing global economy. One of the regional priorities is to expand the region's job base to strengthen the area's historical economic base of agriculture. It is essential for the region's agricultural economy to remain at the cutting edge in crop selection and growing practices, and this requires an

adequate water supply. Many, if not most, DACs in the region are farmworker communities, either historically or currently, or both. Income from agricultural employment is essential to the continued survival of rural DACs, as there are often few non-agricultural employment opportunities in rural areas.

Technological and marketing advances have opened up new global markets for the Region's produce. At the same time, shifts in cropping patterns can have very positive impacts for employment opportunities. Shifts in consumer preferences and technological advances in food processing have created many new economic opportunities in agriculture. Combined with emerging international markets, the volume demand can support a scale of production well beyond the crop levels currently produced. Therefore, value-added food processing can become a much stronger industrial sector in the region, creating an increased number of well-paying jobs, but this can only occur with a sustainable supply of good quality water.

4.4.2 Diversified Economic Base

A stable and reliable water supply is needed to improve economic stability, accelerate the pace of job growth, maintain the quality of life for residents in the region, and diversify the job base. Opportunities for diversification exist both in old and new industrial sectors. Industries such as metal fabrication and machinery that have emerged from the Region's historical agricultural economy are now heavily engaged in production of a wide range of components for the consumer economy. Newer business opportunities in areas such as information technology have also gained a foothold in the region.

Historically, it has been the more recent immigrants to the region (whether from the Chinese in the 1880s and 90s, from the post-Civil War South in the 1900s, from Europe and the American Midwest in the 1930s, from Southeast Asia in the 1960s and 70s, or from Latin America over several decades) who have performed the field work that is so fundamental to the region's agricultural economy. Over time, each wave of immigrants is gradually replaced by the next, as second-generation immigrants find work in other sectors, or in different parts of the agricultural sector. A diversified economy is critical in supporting the upward mobility of each successive generation.

Every year, the area plays hosts to millions of visitors, more than half of which come for recreation. As the region's economy diversifies, demand for business travel will increase, with the need to develop more and better accommodations, amenities, and services. Water is needed to diversify the economy, support recreational uses, and sustain current economic development and land use plans.

4.4.3 Housing

An essential component of housing affordability in the IRWMP area is the impact fees and monthly user fees associated with domestic water supplies. Local governments must commit to providing appropriate programs to promote housing opportunities for all income groups, which is codified in the Housing Element of their General Plan. This plan must

accommodate the Regional Housing Needs Allocation (RHNA) that is formulated at the state level and distributed to the Council of Governments for local allocation. In communities with lower household incomes, water costs constitute a higher percentage of the family budget, and thus have a direct effect on the ability of local governments to meet their housing goals. This problem is exacerbated in those disadvantaged communities who have contaminated drinking water supplies, since they are often compelled to spend money on bottled water or community or household water treatment, bringing the sum total of water expenses to levels exceeding $100 per month in some cases.

4.5 Disadvantaged Communities (DACs) within the Region

The process for identifying and including disadvantaged communities (DACs) in the development of the Kings Basin IRWMP was based on the criteria defined in California Water Code (CWC) §79505.5(a). The CWC identifies "a community with an annual median household income (MHI) that is less than 80 percent of the statewide annual MHI" as disadvantaged. The IRWMP used American Community Survey Estimates from years 2012-2016 data and 80 percent of the statewide annual MHI ($63,783) to reach a DAC MHI threshold of $51,026.

Severely disadvantaged communities (SDACs) are defined elsewhere in the California Water Code as those communities with an MHI less than 60% of the statewide MHI (CWC §13476(j)). Based upon the census numbers noted above, the SDAC threshold is $38,270.

The resulting map of DACs within the region is shown in **Figure 4-1**. **Table 4-2** lists the unincorporated areas that fall under the category of disadvantaged community or severely disadvantaged community within the region. The table includes population and income data.

4.5.1 Small and Severely Disadvantaged Communities

Due to the lower income levels generally found in the San Joaquin Valley and the IRWMP region, most communities meet the definition of a DAC. However, there is a significant difference in capacity between an extremely large DAC such as the city of Fresno with approximately a half million people and a small severely disadvantaged community such as East Orosi or Hardwick (population of a few hundred). For that reason, an emphasis has been placed on understanding the needs of the smaller DACs and SDACs.

The San Joaquin Valley is traditionally rural by nature, and although Valley cities are growing, the agricultural nature of the region ensures that much of the population remains dispersed throughout the vast expanse of the Valley. The region is peppered with tiny towns, often founded and still populated by farmworkers, which can only continue to exist if their basic infrastructure needs can continue to be met. Water is the most essential, and the most local, of these needs. The entities that provide domestic water service to rural towns (usually small special districts or mutual water companies) have very limited

capacity. Operating a well and maintaining a simple distribution system is one thing, but when water treatment plants or other sophisticated improvements are needed, these systems' small size is crippling. They lack the economy of scale to spread costs over many users, and they often lack commercial or industrial users who could contribute revenues.

In addition to economy of scale, other unique challenges faced by small DACs and SDACs include:

- Geographic isolation, making consolidation challenging
- Low revenues and high delinquency rates
- Small or nonexistent reserve funds
- Dependence on a sole source of water
- Small pools of interested, informed individuals who can run the water systems and governing boards
- Lack of equipment and other resources
- Lack of access to technology in an increasingly technological world
- Limited ability to hire paid staff or consultants
- Isolation or exclusion from regional or state dialogue around water policy
- Lack of office space and record storage

4.5.2 Participation and Involvement of Disadvantaged Communities in IRWMP

The purpose of this section is to describe the involvement of the disadvantaged communities in the Kings Basin IRWM planning process.

The IRWMA undertook proactive steps to ensure inclusion of the disadvantaged communities' needs and interests in the planning process of the IRWMP and in the regional project definitions. After the disadvantaged communities' representatives were identified, the IRWMA extended an invitation to attend the IRWMA meetings. Meeting minutes and educational materials were made available to the representatives to help them become familiar with the IRWMA's efforts in developing the IRWMP. The opportunity to join the IRWMA was also extended to interested disadvantaged communities. Several communities that met the criteria for disadvantaged communities have joined the IRWMA in recent years. IRWMA Members and Interested Parties who are DACs are listed in **Table 4-3**. The region also includes many unique DACs who are not IRWMA Members or Interested Parties, listed in **Table 4-2**. The disadvantaged communities, as members of the IRWMA, participated in the development of the Goals and Objectives for the IRWMP. Additional outreach efforts targeted underrepresented communities that were unincorporated. For the DAC communities that remained unrepresented, the IRWMA recruited the services of Self-Help Enterprises, Tulare County, and Community Water Center to identify and provide needs assessment of the unincorporated disadvantaged communities. The needs assessment and a discussion of possible DAC projects can be found in the Kings Basin Water Authority DAC Pilot Project – Final Report.

Table 4-2: Unincorporated Disadvantaged Communities

Community Name	County	Estimated Dwellings	Estimated Population	American Community Survey					Income Surveys		
				Data Year	MHI	Margin of Error	% Margin of Error	% of State MHI	MHI	% of State MHI	Survey Year
Alhambra 1 MHP†	Fresno		50	2005-09	$35,572	GIS Block Group		59%			
Alkali Flats†	Fresno	100		2012-16	$24,022	GIS Block Group		38%			
Armona CSD	Kings	1,202	4,156	2012-16	$44,038	±$9,427	21%	69%			
Bar 20 Partner†	Fresno	15	60	2012-16	$34,028	GIS Block Group		53%			
Beran Way (FCSA #39 A&B)	Fresno	34	158	2005-09	$38,036	±$14,163	37%	63%			
Biola	Fresno	351	1,623	2012-16	$34,911	±$16,577	47%	55%			
Burrel†	Fresno	16		2012-16	$43,875	GIS Block Group		60%			
Calwa†	Fresno	480	2,052	2012-16	$35,000	±$26,680	76%	55%			
Camden Trailer Park†	Fresno	25	100	2012-16	$47,405	GIS Block Group		66%			
Caruthers†	Fresno	639	2,497	2012-16	$44,649	±$7,714	17%	70%	$29,750	49%	2007
Centennial Apartments	Fresno		100	2005-09	$37,371	GIS Block Group		62%			
Centerville†	Fresno	154	392	2012-16	$53,750	±$50,947	95%	84%			
Clarin Apartments	Fresno		100	2005-09	$30,602	GIS Block Group		51%			
Clover MHP	Fresno		50	2005-09	$23,003	GIS Block Group		38%			
Country View Alzheimer Center	Fresno	2	100	2005-09	$44,821	±$59,845	134%	74%			
Cutler†	Tulare	1,136	5,000	2012-16	$29,655	±$5,407	18%	46%			
Date Street†	Fresno	22	22	2005-09	$29,333	±$21,519	73%	49%			
Del Rey†	Fresno	379	1,639	2012-16	$25,809	±$8,670	39%	40%			
Delft Colony†	Tulare	111	454	2011-15	$6,917	±$3,223	223%	11%			
Double L Mobile Ranch Park†	Fresno	37	80	2012-16	$31,248	GIS Block Group		49%			
Doyal's MHP†	Fresno	15	22	2012-16	$42,188	GIS Block Group		66%			
Easton	Fresno	667	2,083	2012-16	$54,716	±$21,458	39%	86%			
Easton Estates Water Company	Fresno	106	371	2012-16	$52,024	GIS Block Group		82%			

Community Name	County	Estimated Dwellings	Estimated Population	American Community Survey					Income Surveys		
				Data Year	MHI	Margin of Error	% Margin of Error	% of State MHI	MHI	% of State MHI	Survey Year
East Orosi†	Tulare	116	495	2012-16	$32,313	±$8,172	25%	43%			
Elm Court†	Fresno	14	40	2012-16	$38,973	GIS Block Group		61%			
El Monte Village MHP	Tulare	49	100	2012-16	$54,559	GIS Block Group		86%	Recommend survey		
Fred Rau Dairy†	Fresno	24	80	2012-16	$43,875	GIS Block Group		69%			
George Cox Water System	Fresno	20	40	2005-09	$49,063	±$44,343	90%	81%	$26,400	41%	2017
Gleanings for The Hungry	Tulare	12	31	2012-16	$32,500	GIS Block Group		51%			
Golden State Trailer Park†	Fresno		50	2005-09	$24,809	GIS Block Group		41%			
Gravesboro†	Fresno		45	2005-09	$34,098	GIS Block Group		56%			
Green Acres Mobile Home Estate	Fresno	112	300	2012-16	$29,252	GIS Block Group		46%			
Hacienda†	Fresno		2	2005-09	$24,809	GIS Block Group		41%			
Hamblin	Kings	40	240	2012-16	$36,238	GIS Block Group		57%			
Hardwick	Kings	37	138	2010-14	$18,250	±$40,787	223%	29%	$23,000	38%	2010
Home Garden†	Kings	437	1,761	2012-16	$33,125	±$8,462	26%	55%			
Kamm Ranch Company†	Fresno		1	2012-16	$43,875	GIS Block Group		69%			
Kings Park Apartments†	Fresno	40	120	2012-16	$41,196	GIS Block Group		65%			
Lacey Courts MHP	Kings		50	2012-16	$47,212	GIS Block Group		74%			
Lanare†	Fresno	147	589	2012-16	$47,875	±$31,144	65%	75%	$30,000	47%	2018
Laton	Fresno	493	1,824	2012-16	$27,721	±$9,799	35%	43%			
Linda Vista Farms†	Fresno	26	40	2012-16	$34,700	GIS Block Group		54%			
London†	Tulare	408	1,869	2012-16	$26,012	±$5,037	19%	41%			
Lopez Labor Camp	Tulare	25	50	2012-16	$29,655	GIS Block Group		46%			
Maddox Dairy†	Fresno		3	2012-16	$33,813	GIS Block Group		53%			
Malaga†	Fresno	268	947	2012-16	$42,250	±$9,979	24%	66%			
Mayfair†	Fresno		1,300	2005-09	$24,375	±$8,143	33%	40%			
Millbrook Mobile Home Village	Fresno		50	2005-09	$38,809	GIS Block Group		64%			

Community Name	County	Estimated Dwellings	Estimated Population	American Community Survey					Income Surveys		
				Data Year	MHI	Margin of Error	% Margin of Error	% of State MHI	MHI	% of State MHI	Survey Year
Monmouth	Fresno		155	2012-16	$27,375	GIS Block Group		43%			
Monson	Tulare	49	188	2012-16	$46,250	±$10,939	24%	73%	$15,000	25%	2010
Monte Verdi FCSA #44D)	Fresno	125	500	2005-09	$40,395	GIS Block Group		67%			
Norseman Mobile Home Park	Tulare	31	70	2005-09	$73,529	±$32,868	45%	122%	Recommend survey		
Old Fig Garden	Fresno		290	2005-09	$45,591	GIS Block Group		75%			
Orosi†	Tulare	2,070	8,770	2012-16	$33,293	±$5,946	18%	52%			
Parkland A.G.†	Fresno		13	2005-09	$25,000	GIS Block Group		41%			
Perry Colony†	Fresno	50		2012-16	$42,278	GIS Block Group		66%			
Raisin City†	Fresno	91	380	2012-16	$18,750	±$24,508	131%	29%			
Riverdale	Fresno	918	3,153	2012-16	$49,100	±$8,143	17%	77%	$35,000	55%	2018
Rubys Valley Care Home	Fresno	1	158	2012-16	$31,324	GIS Block Group		49%			
Seville Water Company	Tulare	108	480	2012-16	$23,000	±$8,973	39%	36%	$14,000	22%	2007
Shady Acre Trailer Park†	Fresno		50	2005-09	$34,273	GIS Block Group		57%			
Shady Lakes MHP†	Fresno	56	130	2012-16	$37,257	GIS Block Group		58%			
Shasta MHP†	Fresno	12	20	2005-09	$23,911	±$5,296	22%	40%			
Sultana	Tulare	242	775	2012-16	$25,486	±$10,427	41%	40%			
Sunnyside Convalescent Hospital†	Fresno	3	116	2012-16	$41,656	GIS Block Group		65%			
Sunset West MHP	Fresno	162	239	2012-16	$29,252	GIS Block Group		46%			
The Willows	Fresno		10	2005-09	$47,471	GIS Block Group		79%			
Three Palms MHP†	Fresno	101	202	2012-16	$41,242	GIS Block Group		65%			
Todd's Trailer Court†	Fresno		50	2005-09	$34,273	GIS Block Group		57%			
Tranquillity†	Fresno	229	799	2012-16	$30,441	±$10,031	33%	48%			
Traver†	Tulare	164	713	2012-16	$31,094	±$11,174	36%	49%			
Valley Care and Guidance	Fresno		158	2005-09	$39,770	GIS Block Group		66%			
Viking Trailer Park	Fresno	48	80	2012-16	$41,109	GIS Block Group		64%			

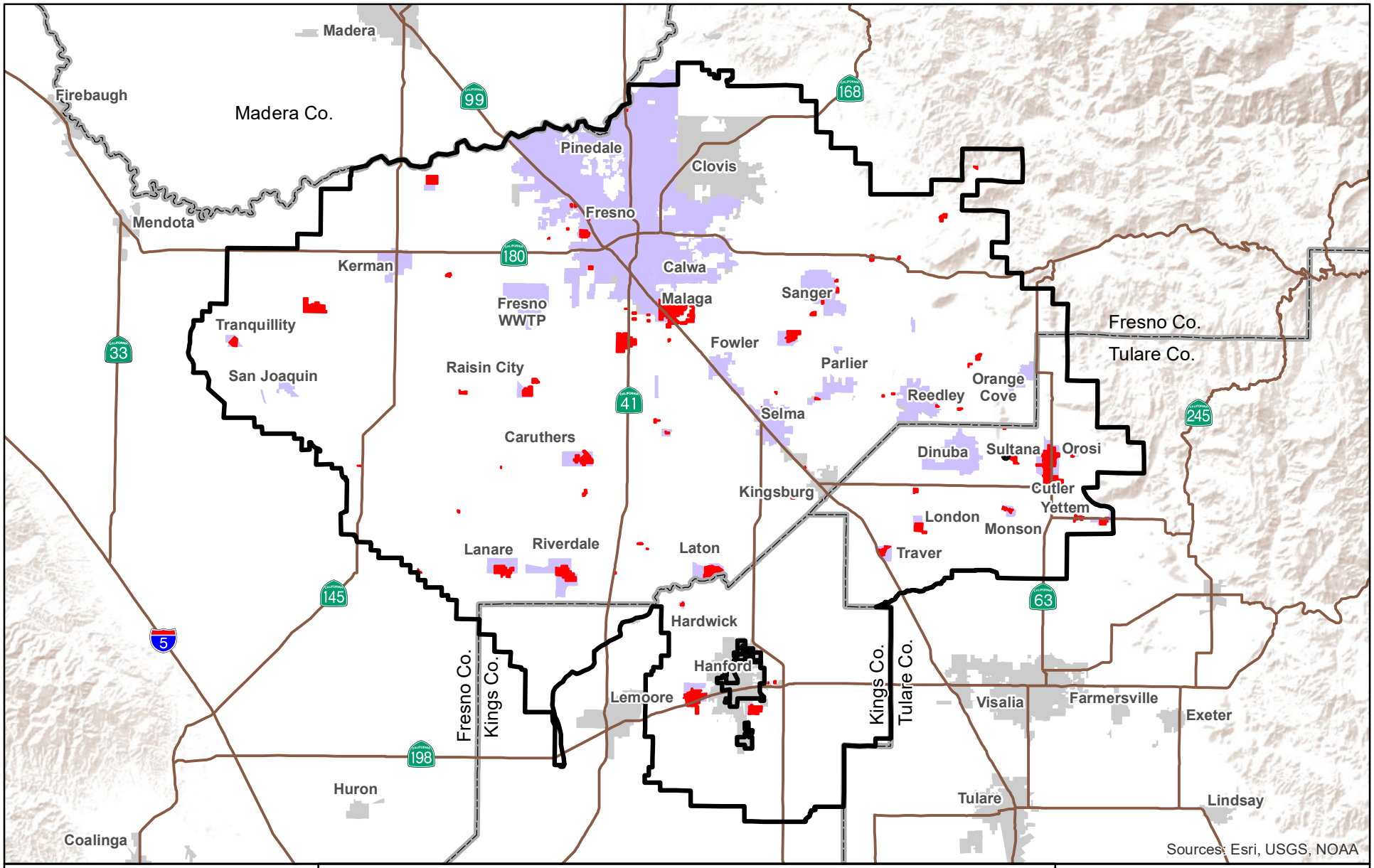
Community Name	County	Estimated Dwellings	Estimated Population	American Community Survey					Income Surveys		
				Data Year	MHI	Margin of Error	% Margin of Error	% of State MHI	MHI	% of State MHI	Survey Year
Del Oro-Metropolitan (Watertek) †	Fresno	29	60	2012-16	$26,667	GIS Block Group		42%			
West Park (FCSA #39 A&B)	Fresno	100	158	2005-09	$44,444	±$12,021	27%	74%			
William Hopkins Water System	Fresno	12	25	2005-09	$44,909	GIS Block Group		74%			
Woodward Bluffs MHP	Fresno	167	300	2012-16	$41,842	GIS Block Group		66%			
Yettem†	Tulare	51	211	2008-12	$27,371	±$11,590	42%	43%			
Zonneveld Dairy†	Fresno	34	141	2012-16	$36,622	GIS Block Group		57%			

Notes:
†Community is designated as an SDAC by one or more of the datasets shown

Table 4-3: IRWMA Member and Interested Party DACs

Community Name	IRWMA Designation[1]	County	Estimated Dwellings	Estimated Population	American Community Survey				
					Data Year	MHI	Margin of Error	% Margin of Error	% of State MHI
Armona CSD	IP	Kings	1,202	4,156	2012-2016	$44,038	±$9,427	21%	69%
Bakman Water Company	IP	Fresno		13,960	2006-2010	$32,767	See Note 1		54%
Biola CSD	IP	Fresno	351	1,623	2012-2016	$34,911	±$16,577	47%	55%
City of Dinuba	M	Fresno	5,868	21,453	2012-2016	$38,008	±$2,669	7%	60%
City of Fresno	M	Fresno	171,288	494,665	2012-2016	$41,842	±$684	2%	66%
City of Kerman	M	Fresno	3,908	13,544	2012-2016	$42,046	±$5,309	13%	66%
City of Orange Cove	IP	Fresno	2,231	9,078	2012-2016	$27,782	±$3,024	11%	44%
City of Parlier	M	Fresno	3,494	14,494	2012-2016	$30,556	±$2,316	8%	48%
City of Reedley	M	Fresno	6,867	24,194	2012-2016	$43,907	±$3,762	9%	69%
City of Sanger	M	Fresno	7,104	24,270	2012-2016	$42,771	±$4,178	10%	67%
City of Selma	M	Fresno	6,813	23,219	2012-2016	$41,086	±$2,751	7%	64%
City of San Joaquin	IP	Fresno	934	4,001	2012-2016	$24,234	±$4,224	17%	38%
Cutler PUD	IP	Tulare	1,136	5,000	2012-2016	$29,655	±$5,407	18%	46%
East Orosi CSD	IP	Tulare	116	495	2012-2016	$32,313	±$8,172	25%	51%
Easton CSD	IP	Fresno	667	2,083	2012-2016	$54,716	±$21,458	39%	86%
Hardwick Water Company	IP	Kings	37	138	2010-2014	$18,250	±$40,787	223%	29%
Lanare CSD	IP	Fresno	147	589	2010-2014	$47,875	±$31,144	65%	75%
Laton CSD	IP	Tulare	493	1,824	2012-2016	$27,721	±$9,799	35%	43%
London CSD	IP	Tulare	408	1,869	2012-2016	$26,012	±$5,037	19%	41%
Malaga CWD	IP	Fresno	268	947	2012-2016	$42,250	±$9,979	24%	66%
Orosi PUD	IP	Tulare	2,070	8,770	2012-2016	$33,293	±$5,946	18%	52%
Raisin City WD	M	Fresno	91	380	2012-2016	$18,750	±$24,508	131%	29%
Riverdale PUD	IP	Fresno	918	3,153	2012-2016	$49,100	±$8,143	17%	77%
Sultana CSD	IP	Tulare	242	775	2012-2016	$25,486	±$10,427	41%	40%

Notes:
(1) M – Member; IP – Interested Party



KINGS BASIN Water Authority

N

0 3 6
Miles

Kings Basin IRWMP
County
City

Places Identified by DWR as DAC
Community* - Tulare Lake Basin DAC Study

* Communities identified as DACs in the Tulare Lake Basin Study, but not by DWR, were not included in population estimates.

FIGURE 4-1

Kings Basin IRWMP

Disadvantaged Communities/Cities

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4.6 Kings Basin DAC Pilot Study

4.6.1 Purpose and Goal

The Authority conducted the Kings Basin DAC Pilot Study in 2012, which culminated in the Kings Basin DAC Pilot Study Final Report. The Pilot Study boundary is coterminous with the Kings Basin Region.

The purpose of the Pilot Study was to engage and integrate the DACs into the Kings Basin IRWM planning process through DAC identification and outreach, needs prioritization, and project development with regards to water, sewer and flooding/storm drain issues. This purpose was accomplished through several tasks and subtasks. Task 1 included the identification, mapping and initial outreach to the DACs within the region. Task 2 included organization of DAC workgroups, outreach meetings, project development and prioritization.

During Task 1, the Kings Basin Region was divided into several smaller, geographic regions to aid in communication, project development and collaborative efforts between DACs. Following the development of the sub-regions, the DACs were mapped, as shown in **Figure 4-1**, and a list was developed to facilitate initial contact with DAC representatives.

Initiation of Task 2 began with setting up community meetings for each sub-region. Each sub-region had up to five community meetings, beginning with a general educational meeting, followed by information gathering and project identification meetings.

Once the data gathering and outreach phases were completed, the Pilot Study workgroup compiled its findings and fully developed one to two preliminary pilot project scopes and cost estimates for each sub-region, which are detailed in the Final Report. These projects were presented to the Authority for review and several were included in the IRWMP Annual Report Project List, as discussed in Chapter 7.

4.6.2 Pilot Study References

During the course of the pilot study, the workgroup used several other studies and sources of information to identify known problems for disadvantaged communities. Those studies include:

- *Tulare Lake Basin DAC Study* (completed in 2014)
- *Addressing Nitrate in California's Drinking Water with a focus on the Tulare Lake Basin and Salinas Valley Groundwater* (Harter Report, 2012)
- *Communities that Rely on Contaminated Ground Water* (SWRCB Report, 2012)

The Tulare Lake Basin (TLB) DAC Study, which overlaps the Kings Basin entirely, is a similar study conducted simultaneous to the Pilot Study but with a much broader purview. The purpose of the TLB DAC Study was to identify feasibility studies and pilot projects

with the end goal of developing an integrated water quality and wastewater treatment program plan for the entire basin. The Pilot Study used a shared data base with the Tulare Lake Basin Study for consistency and to eliminate the duplication of efforts.

The Harter Report and the State Water Resources Control Board report were used as a foundation to identify DAC's with known water quality problems and to incorporate them into the selection process for potential pilot projects.

The Harter Report was written in response to the 2008 passage of Senate Bill SBX2 1, which required the SWRCB to prepare a report to the legislature to "improve the understanding of the causes of [nitrate] ground water contamination, identify potential remediate solutions and funding sources to recover costs expended by the State…to clean up or treat groundwater, and ensure the provision of safe drinking water to all communities" (Harter Report, 2012). The University of California was contracted to prepare the report with a focus on the nitrates in the groundwater of the Tulare Lake Basin and a portion of Salinas Valley. The report categorizes its findings in 6 categories: sources of nitrate pollution, reducing nitrate pollution, groundwater nitrate pollution, groundwater remediation, safe drinking water supply, and regulatory, funding and policy Options

The SWRCB Report was written in response to Assembly Bill AB2222, which required the SWRCB to submit a report to the legislature that identifies: communities in California that rely on contaminated groundwater as a primary source of drinking water; the principal contaminants and constituents of concern; and potential solutions and funding sources to clean up or treat groundwater or provide alternative water supplies (SWRCB Report 2010). The report identifies 682 communities with contaminated groundwater as their primary source and focuses on groundwater quality, not necessarily the quality of water served to the populations within the identified communities. Due to availability of data, the report does not discuss private water supplies or systems not regulated by the State. The proposed solutions in the report fall into three categories: pollution prevention, cleanup, and provision of safe drinking water through alternative water supplies or treatment.

4.7 Disadvantaged Community Issues

The DACs of the Kings Basin region have several significant obstacles to surmount in order to obtain safe drinking water, provide sewer services and plan for flooding/stormwater related issues. Those obstacles include water quality, Technical, Managerial and Financial (TMF) Capacity, economies of scale, aging or inadequate infrastructure, and geographical location.

4.7.1 Water Quality

Many DACs in the region have a long and documented history of water quality violations including nitrate, uranium, arsenic, volatile organics and a variety of other constituents. The contamination in some DACs is sufficient that the communities are, at times, issued "unsafe to drink" or "boil water" orders requiring the use of bottled water exclusively for consumption purposes.

Water quality contaminants in rural DACs and SDACs originate from a variety of sources. Some are naturally occurring, such as arsenic or uranium, which are indigenous to the geology of the area. Other contaminants are related to land use: point source and nonpoint source discharges from agriculture, food processing, dairies, and human wastes. The potential solutions are as varied as the contamination sources and are difficult to standardize across multiple communities due to variables such as geographic location, local hydrologic conditions and chemistry, water system size, water source, and local preference. Solutions often include the following: drilling new or deeper wells or modifying existing wells; to access different parts of the aquifer; treatment facilities including blending; and consolidation in a variety of forms. Occasionally, cease-and-desist orders may be issued to individual polluters, but typically this is not an immediate solution since many types of pollution tends to persist long after the discharge stops.

4.7.2 TMF Capacity & Economies of Scale

TMF Capacity refers to the ability of a community to have Board leadership and personnel with the necessary technical and managerial skills to run the facilities as well as the financial wherewithal of the community to afford the necessary steps required to obtain safe drinking water, provide sewer service or prevent flooding. TMF Capacity is an obstacle that DACs across the country struggle with on a continual basis.

Due to financial constraints, it is often difficult, if not impossible, for a DAC to offer the competitive salaries required to maintain a skilled staff. However, due to the income levels within a DAC, water providers are extremely restricted in their ability to raise rates in order to provide for higher salaries. The end result is a self-perpetuating cycle where the DAC citizens continue to pay for services that can be substandard or virtually non-existent, and the water provider struggles to meet basic expenses.

Economies of scale refer to the cost advantages that an enterprise obtains due to its relatively large size. Small DACs often come out on the losing side of the economy of scale ratio. They shoulder many of the same costs for maintenance, permitting, pumping and staffing as any other water system would, but with a smaller, poorer customer base over which to spread the cost. In this situation, the smaller DACs would often benefit from operating jointly with one or more other small DACs. Each DAC would then only be responsible for a portion of the staffs' salaries, operating costs, consultants cost, etc. By consolidating with other nearby DACs, they could potentially hire more skilled staff and solve a portion of the TMF capacity deficiencies.

Other TMF challenges exist. Small DACs can rarely afford to hire a true manager, so system management often falls by default to volunteer Board members, or to an administrative person that lacks proper technical training or experience. Staff turnover, poor management and technical deficiencies can result from this situation.

A small rate base also makes reserves accumulation difficult. Small water systems often find themselves stuck in a "reactionary" operations cycle, always putting out fires rather

than planning ahead for capital improvements to the system. Some systems operate on a month-to-month basis like a family living from paycheck to paycheck.

These are only a few examples of the TMF challenges that DACs cope with. Closer scrutiny of individual communities reveals unique situations that carry unique problems and unique solutions. TMF is a focus area of both the Kings Basin DAC Pilot Study and the Tulare Lake Basin DAC Pilot Study.

4.7.3 Geographical Location

As discussed previously, several of the issues associated with the DACs can be solved by collaboration or consolidation with other nearby DACs. However, many of the DACs are geographically isolated or lack the clout to negotiate with a larger nearby community. There needs to be a motivation for collaboration or consolidation with all parties. The efforts of the IRWMP are intended to provide a forum where DACs and non-DACs can come together to provide solutions to the regional water supply and quality issues, regardless of geography. The Pilot Study will identify geographic opportunities for solutions.

4.7.4 Aging or Inadequate Infrastructure

The water and wastewater infrastructure of many DACs is substandard or aging. The communities often lack public drinking water infrastructure and rely on shallow, inadequately constructed or sealed private wells or have old and severely leaking distribution systems that result in poor water pressure, bacterial contamination, and other drinking water challenges. Frequently, small DACs lack meters and are therefore unable to monitor water use or implement conservation policies effectively. Many small DACs also have inadequate or failing septic systems. The water and wastewater needs of small DACs were inventoried through the Tulare Lake Basin DAC Water Study and Upper Kings DAC Pilot Study and will be further discussed in Chapter 12.

4.7.5 IRWMP Goals in Relation to DACs

The IRWMA and IRWMP plans to focus on continued outreach to the DACs and encouragement of participation in the IRWMA, as well as support project development and implementation to accomplish water quality Goals and Objectives as part of the Basin plan. The IRWMA produces and will continue to produce an annual report with an updated list of proposed projects in the region, which will include DAC projects that meet regional Goals and Objectives. To support this goal the IRWMA will be committed to fostering relationships with the DACs and maintaining an updated list of the DACs within the region and their primary contact information.

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5 GOALS AND OBJECTIVES

The Kings Basin Water Authority (Authority) developed regional Goals and Objectives to provide focus to their planning efforts. Goals are defined as the highest-level priorities for the region, and objectives are more specific actions that can be taken to meet one or more of the goals. These Goals and Objectives are described below along with the process used to identify them.

5.1 Process and Organization

The process for the development of the regional Goals and Objectives included the following steps:

1. Review the previously developed regional Goals and Objectives in the 2012 Integrated Regional Water Management Plan (IRWMP),
2. Identify the July 2016 IRWMP Guideline requirements for Goals and Objectives, and
3. Consider changed conditions within the basin.

The Goals and Objectives were identified by the IRWMP Update Work Group and later approved by all of the members and interested parties.

To identify the region's Goals and Objectives, the Authority sought to understand the development and consensus building efforts. These were documented in several prior reports, including:

- The original Memorandum of Understanding (MOU) adopted in May 2001 by the Department of Water Resources (DWR), Kings River Conservation District (KRCD), Alta Irrigation District (AID), Consolidated Irrigation District (CID), and Fresno Irrigation District (FID);
- The Water Forum Concept Paper (Upper Kings Water Forum, 2004);
- Basin Assessment Report (WRIME, 2003);
- IRWMP Guidelines (DWR, 2004);
- Existing IRWMP Goals and Objectives (2012 IRWMP);

The Goals and Objectives were also developed using recent State guidelines including 20x2020 Water Efficiency Goals and requirements of California Water Code (CWC) §10541(e)(2).

The existing IRWMP includes Goals and Objectives listed in several areas of the IRWMP, and the July 2016 IRWMP Guidelines requires further clarification to develop a clear understanding and relationship of Goals, Objectives, Resource Strategies and Projects. The Kings Basin has organized the hierarchical pyramid and definitions shown in **Figure 5-1**. It is important to understand one Resource Management Strategy may apply to more than one Measurable Objective, and similarly one Measurable Objective may apply to

more than one Goal. The Goals and Objectives incorporate adaptation for climate change considerations.

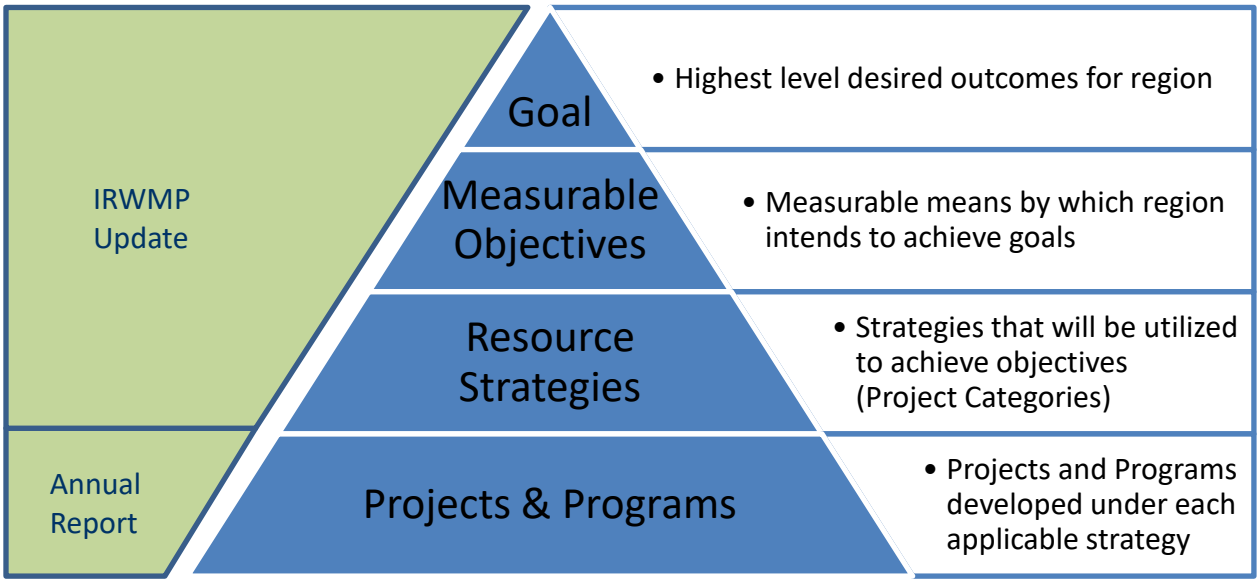

Figure 5-1: Goals and Objectives Hierarchy

The goals and measurable objectives are discussed in the two following sections. Resource Management Strategies are discussed in Section 6.

5.2 Regional Goals

The review of the existing goals determined that the primary goals for the Region listed in the 2007 IRWMP remain the highest-level priorities for the Region. These Regional Goals (RG) remain the primary goals for the region and are listed below. Correction of the overdraft has previously been considered the highest priority for the entire region, however within certain areas of the region and for certain stakeholders, water quality and water reliability are higher priorities than overdraft correction. The RGs have not been ranked but have been identified with a number to clarify relationships between objectives, resource management strategies, and projects. These goals were seen as the highest-level priorities for the region, consolidating urban, agricultural and environmental concerns.

Table 5-1: Regional Goals

No.	Goal
RG1	Halt, and ultimately reverse, the current overdraft and provide for sustainable management of surface and groundwater
RG2	Increase the water supply reliability, enhance operational flexibility, and reduce system constraints
RG3	Improve and protect water quality
RG4	Provide additional flood protection
RG5	Protect and enhance aquatic ecosystems and wildlife habitat.

5.2.1 RG1 – Halt the Current Overdraft and Provide for Sustainable Management of Surface and Groundwater

Groundwater overdraft continues to be a significant concern for the Kings Basin. The Kings Basin Integrated Groundwater and Surface Water Model (IGSM) provided the technical basis for quantifying the existing and potential future overdraft (WRIME, 2005). The model and related technical work helped the region by providing data and analysis results to conclude that a primary water management goal should be to "halt and ultimately reverse the current overdraft of the groundwater aquifer". This goal will help lead to overall maintenance or improvement in the quantity, quality and cost of development of groundwater resources in the region. Overdraft increases the competition for the available supply and creates conflicts between agricultural, environmental, and urban water users, and between geographic areas within the region. Declining groundwater levels and groundwater migration across jurisdictional boundaries are also a potential source of increased conflict. This goal integrates the surface and groundwater management that can then reconcile and measure project benefits over time with current baseline data shown in a basin water balance format.

5.2.2 RG2 – Increase Water Supply Reliability, Enhance Operational Flexibility, and Reduce System Constraints

Water demand has exceeded the available surface and groundwater supplies as they are currently developed and managed with the existing capital facilities and institutional arrangements. A reliable surface water supply is not assured in normal and dry years. Groundwater makes up the balance of urban and agricultural water demands when surface water is not available. In addition, some areas in the basin are entirely reliant on groundwater. Therefore, the long-term sustainability and reliability of the surface and groundwater supply must be addressed in the IRWMP. Increasing operational flexibility and reducing system constraints are integrated into this goal.

5.2.3 RG3 – Improve and Protect Water Quality

Many areas within the region have significant groundwater quality concerns, limiting available suitable supply. Continued and further degradation of water quality and the migration of poor quality water are significant concerns in the overall operation of the groundwater basin. Therefore, existing water quality needs to be maintained or improved to ensure that there is water of acceptable quality to meet current and future agricultural, urban, and environmental requirements. Understanding the improvement from regional water quality projects in current areas of poor quality groundwater, i.e., nitrates, arsenic, dibromochloropropane (DBCP), Perchlorate, and Hexavalent Chromium, is integrated into this goal.

5.2.4 RG4 – Provide additional flood protection

Flood protection levels within the region are varied, and major storm events in certain areas have the potential for significant impacts to existing land use. Regional and local flood control facility improvements will help better manage flood runoff, protect existing or proposed land uses of all types, and capture water to balance supply.

5.2.5 RG5 - Protect and enhance aquatic ecosystems and wildlife habitat.

The region is committed to aquatic ecosystem enhancement as demonstrated by the Kings River Fisheries Program (see Section 9.1). Protecting and enhancing the fisheries program and wildlife habitat within the region remains a priority goal for the region through the establishment of standalone ecosystem and wildlife programs, as well as incorporation of habitat improvements within new project development.

5.3 Measurable Objectives

Measurable Objectives were developed to accomplish the Goals of the Region. Objectives identified throughout the 2007 IRWMP were consolidated and measurements added. Combined with Goals of the region, the following Measurable Objectives (MO) address the requirements of CWC §10540(c). Some of the Objectives apply to multiple Goals for the Region, so the applicable Goals for each Objective are included in the table below.

Table 5-2: Measurable Objectives

No.	Applies To Goals	Objective	Measurement
MO1	RG1, RG2	Increase amount of groundwater in storage with intent to eliminate the groundwater overdraft in 20 years	Report of change in overdraft in accordance with Section 12.2 and net effect of new projects capacity/performance
MO2	All	Identify opportunities and Projects	List of projects and opportunities and their potential
MO3	RG1, RG2 RG3, RG4	Identify DAC priority needs and promote/support solutions to DAC water issues	DAC studies and project development/implementation
MO4	RG1, RG2 RG3, RG4	Increase average annual supply and reduce demand	Documentation of amount of increase/decrease
MO5	RG1, RG2	Increase dry year supply	Documentation of amount of increase
MO6	RG2, RG4	Increase regional conveyance capacity and adapt operations to accommodate changes in runoff and recharge	Total AF available (both capacity and re-operation)
MO7	RG3	Compile baseline water quality data for ground & surface water	Report of data collected and evaluate changes in the basin in annual report by considering population served and compliance orders from available sources such as ECHO and SDWIS
MO8	RG3	Encourage Best Management Practices, policies & education that protect water quality	Documentation of efforts/education
MO9	RG3	Identify sources of water quality problems & promote/support solutions to improve water quality	Report of information gathered
MO10	All	Increase surface storage	Documentation of amount
MO11	RG5	Sustain the Kings River Fisheries Management Program	Report on program
MO12	RG5	Pursue opportunities to incorporate habitat benefits into projects	List of opportunities considered and accomplishments
MO13	All	Increase public awareness of IRWM Efforts	Public relations and annual reporting
MO14	All	Involve local water districts and land use agencies in generating and confirming the current and future water needs to ensure compatibility and consistency with land use and water supply plans.	Tracking of Involvement with land use planning officials and inclusion in planning documents.

No.	Applies To Goals	Objective	Measurement
MO15	RG1, RG2	Comply with SBx7-7	Review of compliance by stakeholders
MO16	All	Pursue opportunities to include project elements that reduce energy consumption, reduce greenhouse gas emissions, use renewable resources or include carbon sequestration strategies.	List of opportunities considered and accomplishments

5.4 Program Preferences

The State of California established 15 Program Preferences (formerly Program Preferences and Statewide Priorities) for IRWMPs. These Program Preferences are listed and described in the DWR IRWM Guidelines. The Program Preferences are specific topics that should be addressed in IRWMPs. Each Program Preference is addressed in this IRWMP, and they were also an important consideration in identifying Goals and Measurable Objectives. **Table 5-3** lists the Measurable Objectives and with which Program Preference they are consistent.

Table 5-3: Program Preferences

No.	Program Preferences	Measurable Objectives															
		1 – Increase Groundwater Storage	2 – Identify Opportunities/Projects	3 – Identify DAC Needs and Solutions	4 – Increase Supplies / Reduce Demands	5 – Increase Dry Year Supply	6 – Increase Conveyance Capacity	7 – Compile Baseline Water Quality Data	8 – Water Quality Education	9 – Improve Water Quality	10 – Increase Surface Storage	11 – Sustain Kings River Fisheries	12 – Incorporate Habitat Benefits	13 – Increase Public Awareness of IRWMP	14 – Improve Water/Land Use Planning	15 – Comply with SB7x-7	16 – Reduce Energy Consumption and GHG
1	Regional Project/Programs		◆														◆
2	Defined Hydrologic Region													◆			
3	Resolve Water Conflicts													◆	◆		
4	Bay-Delta Program Objectives																
a	Water Quality								◆	◆							
b	Levee Integrity										◆						
c	Water Supply Reliability				◆												
d	Ecosystem Restoration												◆				
5	Disadvantaged Communities			◆				◆	◆	◆				◆			
6	Integrate Water/Land Use Planning													◆	◆		
7	Stormwater Planning						◆				◆				◆		
8	Drought Preparedness	◆			◆	◆					◆						
9	Water Efficiency				◆											◆	◆
10	Climate Change Response				◆	◆	◆				◆	◆	◆				◆
11	Environment Stewardship											◆	◆				
12	Integrated Flood Management						◆				◆						
13	Protect Water Quality			◆				◆	◆	◆			◆				
14	Improve Tribal Resources													◆			
15	Equitable Distribution of Benefits		◆	◆					◆					◆			

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6 RESOURCE MANAGEMENT STRATEGIES

6.1 Introduction

A resource management strategy (strategy) is defined as a project, program, or policy that helps local agencies and governments manage their water, and related resources (DWR, 2013 California Water Plan Update). Resource management strategies include structural and non-structural solutions. Structural solutions involve development of capital facilities such as conveyance structures (pipelines or canals), recharge ponds, and water treatment plants. Non-structural solutions are programmatic or policy solutions, such as drought response plans or water conservation ordinances.

The 2013 California Water Plan Update describes 31 different resource management strategies. The State does not expect that all strategies be practiced in every region but encourages water managers to employ as many strategies as practical to diversify their water management portfolio. This Integrated Regional Water Management Plan (IRWMP) evaluates 31 strategies listed in the 2013 California Water Plan Update, as well as 'Drought Planning', a strategy added by the Kings Basin Water Authority (Authority) within the "Other Strategies" category. The evaluations include the following:

- Description of the strategy
- Discussion of current use in Kings Basin
- Evaluation of applicability in the Kings Basin
- Constraints to development
- Impacts of climate change on the efficacy of the strategy
- Ability of strategy to help adapt to climate change impacts

The strategies were evaluated through an open and transparent process by the IRWMP Update Work Group and further considered by the Authority members & interested parties. The Work Group individually evaluated each strategy, identified which were applicable to the region, and discussed the future of the strategy.

Table 6-1 shows the 31 strategies that were evaluated, and which are applicable to the Kings Basin. Those that are not currently applicable will be periodically reviewed as part of the IRWMP's adaptive management strategy. The Kings Basin actively uses 28 of the strategies and, as a result, maintains a diverse and comprehensive water management portfolio.

Table 6-1: Resource Management Strategies

Category	Strategy	Applicable to Region
Reduce water demand	Agricultural water use efficiency	X
	Urban water use efficiency	X
Improve operational efficiency and transfers	Conveyance – Delta	
	Conveyance - regional/local	X
	System reoperation[1]	X
	Water transfers	X
Increase water supply	Conjunctive management and groundwater	X
	Desalination – Brackish & Seawater	
	Precipitation enhancement	X
	Recycled municipal water	X
	Surface storage – CALFED	
	Surface storage – Regional/Local	X
Improve water quality	Drinking water treatment and distribution	X
	Groundwater / Aquifer remediation	X
	Matching quality to use	X
	Pollution prevention	X
	Salt and salinity management	X
	Urban stormwater runoff management	X
Improve flood management	Flood risk management	X
Practice resource stewardship	Agricultural lands stewardship	X
	Ecosystem restoration	X
	Forest management	X
	Land use planning and management	X
	Recharge area protection	X
	Sediment Management	
	Watershed management	X
People & Water	Economic incentives (loans, grants & water pricing)	X
	Outreach and Engagement	X
	Water and Culture	X
	Water-dependent recreation	X
Other strategies	Crop idling for water transfers, dew vaporation, fog collection, irrigated land retirement, rainfed agriculture, waterbag transport, and drought planning[2].	X

1 – Reevaluated for use periodically
2 – Added by Kings Basin Water Authority

Following is a general description of each strategy and its use in the Kings Basin. Refer to the 2013 California Water Plan Update for further detail on each strategy.

6.2 Reduce Water Demand

6.2.1 Agricultural Water Use Efficiency

Agricultural water use efficiency can be improved through a variety of measures by the governing irrigation or water district, and by local growers. The 2013 California Water Plan Update lists 16 Efficient Water Management Practices (EWMPs) including:

- Measure volume of water delivered
- Adopt volumetric pricing structure
- Facilitate alternative land use (drainage)
- Facilitate use of recycled water
- On-farm irrigation systems improvements
- Implement incentive pricing structure
- Canal lining and piping to reduce seepage
- Flexible water ordering
- Spill and tail-water recovery systems
- Conjunctive use of surface and groundwater
- Automate canal-control structures/telemetry
- Facilitate customer pump testing
- Water conservation coordinator
- Water management services to water users
- Policy changes
- Improve efficiency of supplier pumps

These EWMPs are used throughout the Kings Basin and are an important component of the regional water management strategy. Their use varies by irrigation and water district. In some areas, certain EWMPS are not used because they are not economical or practical. For instance, some districts do not line their canals because canal seepage is an important part of their conjunctive use program. Some EWMPs are implemented on a regional scale, such as the Agricultural Water Enhancement Project (AWEP), a program to help improve on-farm water management that is administered by Kings River Conservation District (KRCD) (see section 6.7.2 – Economic Incentives for more details).

Alta Irrigation District (AID), Fresno Irrigation District (FID), and KRCD are signatories to the Agricultural Water Management Council (Council) Memorandum of Understanding (MOU). The Council is a non-profit organization that promotes improvements in agricultural water efficiency and provides technical assistance in preparing Agricultural Water Management Plans (AWMP), which documents successes and goals in implementing EWMPs.

California Senate Bill x7-7 (SBx7-7) required agricultural water suppliers to prepare an AWMP by the end of 2012, which addresses each of the aforementioned EWMPs. Agencies that did not complete an AWMP are not be eligible for certain State grants or loans. Water Management Plans prepared for the USBR or the Agricultural Water Management Council will be considered suitable replacements for the State AWMP.

Some obstacles to implementing EWMPs include: lack of grower interest, funding and cost-effectiveness, high water use efficiencies in some areas that reduce feasibility of further water conservation, and local conditions such as topography, micro-climates, etc., that make certain EWMPs impractical.

6.2.2 Urban Water Use Efficiency

Urban water use efficiency results in benefits to water supply and quality through technological and behavioral improvements that decrease indoor and outdoor residential, commercial, industrial, and institutional water use. The primary methods used to improve urban water use efficiency, often called best management practices (BMP) or demand management measures (DMM), are listed below:

- Water survey programs
- Residential plumbing retrofits
- Water system audits
- Metering
- Large landscape conservation programs
- Washing machine rebates
- Public information programs
- School education programs
- Conservation programs for commercial, industrial and institutional accounts
- Wholesale agency assistance programs
- Retail conservation pricing
- Conservation coordinator
- Water waste prohibition
- Low flow toilet replacement

All of these BMPs are practiced in the Kings Basin, but the level of practice varies by water agency. Large municipalities in the region (i.e. Fresno and Clovis) have extensive urban water conservation programs, but they can be difficult to fund and administer in smaller communities. New conservation measures are constantly being developed. For instance, in 2014 Fresno County developed a water conservation ordinance for their 21 water districts that includes an emergency response plan and conservation rules.

The SBx7-7, also known as the Water Conservation Act of 2009, set a goal of reducing per capita water use by 20% by 2020. To meet these goals, some agencies will need to increase their urban water conservation efforts. Urban Water Management Plans are the primary document for recording urban water conservation measures. A list of agencies

that have current Urban Water Management Plans (UWMPs) is provided in Section 13 – Relation to Local Water Planning.

Obstacles to implementing urban water use efficiency measures include funding, public acceptance, reduced revenue from lower water sales, and poor economics (other alternatives such as developing new water supplies may be less expensive).

6.3 Improve Operational Efficiency and Transfers

6.3.1 Conveyance- Delta

Delta conveyance includes managing, conveying and diverting water from the Sacramento-San Joaquin River Delta. The County of Fresno does depend on Delta conveyance with their Cross Valley Canal contract. They have a contract for 3,000 AF from the Shasta unit of the CVP. The water is delivered to Fresno County through a water exchange. While this isn't an integral part of the KBWA, a member entity of the IRWMP does have very tenuous connection to the Delta and conveyance.

6.3.2 Conveyance – Regional/Local

Conveyance provides for the movement of water from the source to areas of need and includes natural channels and constructed facilities, such as canals, pipelines, pumping plants, and diversion structures. Conveyance facilities in the region range in size from small, local end-user distribution systems to large systems that deliver water within each of the irrigation districts. Specific objectives for natural and managed water conveyance activities include urban and agricultural water deliveries, flood management, consumptive and non-consumptive environmental uses, and recreation.

Some conveyance facilities have physical restrictions that limit the volume of water that can be delivered during flood releases, or the volume delivered during peak summer demand period. In some instances, the irrigation systems distribution infrastructure is used by urban areas to convey storm water and this can limit the ability to divert and recharge flood water. Greater conveyance capacity's improved automation and controls can increase operational flexibility and could be used to deliver surface water to water treatment plants or areas that currently rely on groundwater for their water needs.

Enterprise Flume and Canal - Fresno Irrigation District

Demand for higher conveyance capacity may increase if climate change modifies the timing and volume of river and stream flows. Increased capacity may be needed to deliver water during different times of the year, or to deliver high volumes during short durations.

6.3.3 System Reoperation

System reoperation involves changing existing operation procedures for existing reservoirs and conveyance facilities to increase water related benefits. System reoperation may improve the efficiency of existing water uses or it may increase the emphasis of one use over another. For instance, system reoperation could involve changing reservoir release schedules to improve fisheries or provide flood control. Reoperation may require new facilities or permits and is sometimes legally challenged. Reoperation could be a strategy to adapt to changes in amount, intensity and timing of runoff.

The Kings River water rights are managed by the Kings River Water Association (KRWA). The primary guidebook for managing Kings River water is the KRWA "Blue Book", which defines the operational policies for the 28 members with water rights to the Kings River. The Blue Book has been instrumental in reducing conflicts between water users, managing available surface supplies, and resolving water rights disputes and interregional water rights issues in the IRWMP Region.

KRWA, KRCD and the California Department of Fish and Game (DFG) jointly developed the innovative Kings River Fisheries Management Program. The program is a voluntary effort by water users to enhance fisheries in the Kings River through a temperature control pool in Pine Flat reservoir, increases in minimum river releases, and several other measures. The program has been successful at improving the local fisheries with support from KRWA members.

Whole scale reoperation of the Kings River is not considered feasible after the improvements made by the Kings River Fisheries Management Program, and legal obligations and water rights documented in the Blue Book. It is believed that Kings River water supplies are being operated as efficiently as possible, within existing legal obligations. However, individual members, such as irrigation districts, may be able to adjust operations to reduce spills, although spills are still relatively low in the Kings Basin. The Fresno Metropolitan Flood Control District (FMFCD) suggested there may be potential to re-operate flood flows at Big Dry Creek Reservoir, although additional study is needed. Changes in water demands and climate change could provide the need for re-operation, and consequently re-operation options will be periodically evaluated.

6.3.4 Water Transfers

Water transfers are defined in the California Water Code (CWC) as a temporary or long-term change in the point of diversion, place of use, or purpose of use as a result of a transfer or exchange of water or water rights. Water transfers can help areas obtain new water supplies, increase supply reliability, reduce or eliminate overdraft, or generate revenue if water is transferred out. Water transfers have become a common part of the local water management landscape. Constraints to water transfers in the Kings Basin include: 1) consistency with KRWA and other local policies; 2) local and state political acceptability; 3) regulatory issues; 4) cost; and 5) availability of facilities.

Water transfers can be intra-basin or inter-basin. Intra-basin transfers have historically occurred between KRWA member water districts. Intra-basin transfers can be useful for conjunctive use projects, and to reduce the volume of water that flows out of the Basin in wet years. Inter-basin transfers into the Kings Basin could create a new source of water to improve supply reliability and make use of available groundwater storage. Inter-basin transfers from the San Joaquin River via the Friant Division of the Central Valley Project (CVP) historically have occurred. Water-rights issues would need to be resolved through KRWA and possibly State Water Resources Control Board (SWRCB) if transfers were to occur outside of the Kings River place of use. Both intra-basin and inter-basin transfers are viable strategies in the Kings Basin and present opportunities to increase water supplies. In the near term, priority should be on transfers and exchanges within the KRWA area since these are less complex and controversial. In the longer term, the Kings Basin will consider transfers, exchanges, and water banking with interests outside of the area so long as there are tangible, measurable water supply benefits to the Kings Basin.

6.4 Increase Water Supply

6.4.1 Conjunctive Management and Groundwater Storage

Conjunctive management, also referred to as conjunctive use, is the coordinated and planned management of both surface and groundwater resources in order to maximize their efficient use. Conjunctive management is used to improve water supply reliability and environmental conditions, reduce groundwater overdraft and land subsidence, and protect water quality. Since overdraft has a great potential for causing conflicts within the Kings Basin, the Authority has established conjunctive management and groundwater storage as the primary focus of the IRWMP. Overdraft has the greatest potential to result in conflicts between water users, result in economic losses to both urban and agricultural economies, and impacts to the environment.

Groundwater Recharge in the City of Clovis

Conjunctive use includes several components including recharge, followed by groundwater use during dry periods, and a robust monitoring program to help prevent negative impacts and verify the quantity of water in storage.

Conjunctive management has great potential to increase groundwater storage and water reserves. Pine Flat Reservoir can store upwards of 1,000,000 acre-feet (AF) of water. However, the Kings Basin has an available storage capacity of 93,000,000 AF to a maximum depth of 1,000 feet (DWR, 2006 Bulletin 118 Basin Description).

The Kings Basin has a long history of conjunctive use that has resulted in significant water supply benefits. The history of success, familiarity with conjunctive use operations, and demonstrated benefits of such approaches will make it easier for the area to further

expand the conjunctive use program. WRIME (2006) prepared a Regional Conjunctive Use Feasibility Study to evaluate the potential for expanding the existing programs; provide a basis of design for additional facilities; and evaluate the scientific and technical merit of proposed projects. Figure 6 in the feasibility study is a map of 'Recharge Potential Index', which identifies areas with high potential for recharge.

Surface water sources in the area, San Joaquin River and Kings River, are fully appropriated, but they do offer surplus flows in wet years. Another possible source is imported water obtained through purchase, exchange or transfer. The region has considerable capacity to absorb wet year waters, but there is still substantial potential for new facilities. In 2011, and again in 2017, approximately 500,000 AF of Kings River water flowed out the Kings Basin area through the Kings River and its distributaries.

Water ponded in recharge basins can also be used to meet local demands. The FMFCD is now using surface water in many basins as a source of landscape irrigation within the basin. Irrigating areas outside, but near the basins, is also possible.

Constraints to developing conjunctive use facilities include:

- Access to prime recharge lands;
- High cost of purchasing land and developing recharge basins and recovery wells;
- Limitations in conveyance capacity to deliver water to basins;
- High operational costs, especially if recharged water is not later recovered and sold;
- Risk that water stored cannot be extracted when needed because of infrastructure, water quality or water level, politics, and institutional or contractual provisions;
- Lack of assurances to prevent third-party impacts and increase willingness of local citizens to participate;
- Potential for recharge to cause migration of known contaminants that would affect municipal or domestic supplies.

In the long term, the Authority should seek opportunities for interregional conjunctive use programs that include water importation and groundwater banking involving third parties, as long as these projects benefit the Kings Basin and appropriate safe guards are established.

6.4.2 Desalination – Brackish and Seawater

Desalination is a water treatment process for the removal of salts from water for beneficial use. Desalination is not only used on seawater, but also on low-salinity (brackish) water from groundwater or other sources. In California, reverse osmosis is the principal method for desalination. This process can also be used to remove other specific contaminants in water, such as trihalomethane precursors, volatile organic carbons, nitrates, and pathogens. The benefits of desalination include:

- Increased water supply;
- Reclamation and beneficial use of impaired waters;
- Increased water supply reliability during drought periods;
- Diversified water supply sources;
- Improved water quality; and
- Public health protection.

The constraints for desalination in the Kings Basin include lack of saline water sources, cost for plant construction and operation, and brine disposal. These constraints limit the applicability of desalination for the IRWMP Region. There are no current opportunities for desalination and it is not a viable strategy for the region.

6.4.3 Precipitation Enhancement

Precipitation enhancement, commonly called 'cloud seeding', artificially stimulates clouds to produce more rainfall or snowfall than would naturally occur. This is performed by injecting seeding agents into the clouds that enable snowflakes and raindrops to form more easily. Precipitation enhancement is not a remedy for drought, since opportunities are generally fewer in dry years. Rather, it works better in combination with surface or groundwater storage to increase 'average' supplies. Most projects suspend operations during very wet years once enough snow has accumulated to meet their water needs.

Aerial Cloud Seeding

Cloud seeding has been conducted for the Kings River watershed since the 1950's through the Kings River Weather Modification Program. The program is the longest running cloud seeding operation in California. The core operational project period is December through March, with the possibility of extending the period due to water supply conditions. The program utilizes the following methods: 1) aircraft seeding of storms as they approach the Sierra foothills upwind of the target area, and 2) seeding using an array of ground-based seeding generators in the foothills. Both seed modes are targeting the pool of low-altitude supercooled liquid water that develops in-cloud over the windward slopes of mountain barriers.

Analyses of the seeding effectiveness have been made at intervals throughout the project's history. A recent published estimation indicates a long-term average increase in Pine Flat Reservoir inflow of about "5.1%, with 90% confidence that the true effect of seeding is somewhere between +1.5% and +8.8%" (Silverman, 2007). Recent estimations using April 1 snowpack data indicate that, over the full seeded history of the project, an average increase of approximately 4% to 6% has occurred. These numbers fall within the range of 2 to 15 percent cited by the 2009 California Water Plan Update for other successful cloud seeding programs.

Climate change could impact the timing and nature of precipitation events, making it difficult to operate cloud seeding operations since past weather may not be good indicators of future conditions. However, in the snow zone, cloud seeding could offset some of the loss in snowpack expected from global warming. According to the 2009 California Water Plan Update, the State should support research on potential new seeding agents, particularly ones that work at high temperatures. Global warming may limit the effectiveness of silver iodide, the most commonly used agent, which requires cloud temperatures well below freezing, around -5°C, to be effective.

6.4.4 Recycled Municipal Water

Recycled water can be used for a variety of purposes depending on its level of treatment. Some common uses include non-edible crop irrigation, freeway landscaping, groundwater recharge, and industrial processes. The State is supporting the use of reclaimed wastewater as documented in the State Water Plan and the recommendations of California's Recycled Water Task Force (DWR, 2003b). The SWRCB has compiled the statutes and regulations pertaining to reuse of recycled water in the "California Statutes Related to Recycled Water" (SWRCB, 2017) and in the "Regulations Related to Recycled Water" (SWRCB, 2015). SWRCB defines the appropriate legal uses based on the level of treatment (primary, secondary, or tertiary). One of the most common uses for recycled water is groundwater recharge. However, groundwater recharge projects that use reclaimed wastewater require SWRCB and Regional Water Quality Control Board (RWQCB) approvals based on effluent quality and quantity, spreading area operations, soil characteristics, hydrogeology, residence time, and distance to withdrawal.

Within the Kings Basin there is more than 100,000 AF/year of wastewater that is treated. Most of this water is percolated to the groundwater or evaporated. The City of Fresno has a reclamation facility, North Fresno Regional Wastewater Reclamation Facility, which treats wastewater for landscape irrigation. The City of Clovis also has a program for directly using recycled water. To increase direct use of recycled water the region would need to make substantial investments in new treatment and distribution infrastructure. Obstacles to using recycled water include the high cost, lack of water supply benefits when recycled water is already being recharged, regulatory issues, public acceptance, and marketability of recycled water. However, the region recognizes that some recycled water supplies are an untapped source, and they will gradually be developed as demands increase.

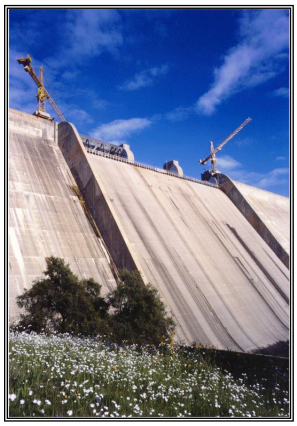
6.4.5 Surface Storage – CALFED

The CALFED Bay-Delta Program, also known as CALFED, was a department within the government of California that focused on interrelated water problems in the state's Sacramento-San Joaquin River Delta. In 2009, CALFED was replaced by the Delta Stewardship Council. 'CALFED Surface Storage' is the legacy name for a resource management strategy to improve surface storage while simultaneously improving conditions in the Delta. The CALFED Surface Storage strategy includes five potential surface storage reservoirs in California. A surface water storage project in the upper

reaches of the San Joaquin River could provide water supply benefits to Friant CVP contractors in the Kings Basin (see **Table 3-3**).

6.4.6 Surface Storage – Regional/Local

Surface storage is the use of on- or off-stream reservoirs to collect water for later release and use. Pine Flat Reservoir has played an important role in the region where the pattern and timing of water use does not match the natural runoff pattern. The reservoir has provided historical benefits in the areas of conjunctive management and flood control. KRCD, KRWA, and the US Army Corps of Engineers manage Pine Flat Reservoir and upstream reservoirs to provide storage for KRWA members. Friant Dam provides storage and regulation of San Joaquin River water.



Friant Dam on the San Joaquin River

Smaller storage projects include reservoirs on the Fresno Stream group that provide flood control and some storage benefits. Building large-scale surface storage in California and the nation as a whole is difficult because most of the prime sites already have been dammed and regulatory, political, and economic constraints make planning for and construction of dams extremely slow and difficult. Small-scale reservoir projects may hold more promise due to the significant expense of developing large-scale surface storage. Off-channel reservoirs have been successfully developed by irrigation and water districts in the San Joaquin Valley and offer potential to some local agencies. In the future, if climate patterns change causing reduced snow pack and increased winter runoff, the priority for surface storage for water supply and flood control purposes could change.

6.5 Improve Water Quality

6.5.1 Drinking Water Treatment and Distribution

Providing a reliable supply of safe drinking water is the primary goal of municipal water systems. To achieve this goal adequate water treatment and distribution facilities are needed. Water treatment must meet State and Federal drinking water standards. The primary constraints to developing water treatment and distribution systems include high capital cost, high O&M cost, and opposition to higher water rates. Climate change could impact water quality and impact the need for or type of water treatment provided. For instance, more intense precipitation could increase turbidity, and higher temperatures may lead to eutrophic conditions in storage reservoirs.

Most cities in the Kings Basin rely on groundwater to meet municipal needs. Aging infrastructure, urban growth, more strict water quality standards and rising treatment costs pose challenges. The cities of Clovis and Fresno have constructed surface water treatment facilities to reduce reliance on overdrafted groundwater and to make use of available surface water supplies. Use of surface water in-lieu of groundwater helps reduce overdraft and leaves water in storage in the groundwater basin for use in dry years when surface supplies are less available. Other areas in the basin will likely follow this trend. Construction of regional treatment plants, shared by multiple agencies, could be more economical than constructing several separate plants.

Water Storage Tank in Western Fresno County

6.5.2 Groundwater / Aquifer Remediation

Groundwater remediation involves extracting contaminated groundwater from the aquifer, treating it, and discharging it to a water course or using it for some other purpose, or injecting it back into the aquifer. Contaminated groundwater can result from a multitude of both naturally occurring and anthropogenic sources. Remediation results in an additional water source that would not be available without remediation, but groundwater treatment is expensive, and years or decades may be required to remediate contaminated groundwater sites. Groundwater in the Kings Basin is remediated in numerous locations under the jurisdiction of regulatory programs. These projects typically address specific plumes.

6.5.3 Matching Quality to Use

Matching water quality to use is a strategy that attempts to match water uses with the appropriate water quality. This strategy also tries to avoid using high quality water for certain uses that do not require it. In the Kings Basin, providing treated surface water to municipalities in-lieu of groundwater follows this strategy since groundwater underlying many municipal areas requires treatment. This approach also provides groundwater storage benefits. The groundwater of diminished quality can be applied to other uses, such as irrigation. In addition, re-using wastewater effluent, non-potable surface water or canal water for groundwater recharge or landscape irrigation are further examples of matching quality to use in the Kings Basin. Obstacles to matching quality to use are public acceptance of using lower quality water (even if it acceptable for the intended use),

and the geographical distribution of the water supplies with different qualities, which may not be in or near places they can be beneficially used.

6.5.4 Pollution Prevention

For the vast majority of contaminants, it is generally accepted that a pollution prevention approach is more cost-effective than end-of-the-pipe treatment of wastes or advanced water treatment for drinking water. However, because of the nature and sources of some contaminants, a pollution prevention approach may not be possible, cost-effective, or desirable in some instances. In the Kings Basin, pollution prevention is practiced primarily through regulatory programs for irrigation, confined animal facilities, urban activities, wastewater disposal, and industrial activities. Some water facilities are also fenced, or access is limited, partly to help preserve good water quality. Pollution prevention also overlaps with the Forest Management and Watershed Management strategies that aim to reduce eroded sediment and pollution from entering water sources.

6.5.5 Salt and Salinity Management

Salt and salinity management includes efforts to limit buildup of salts in the soil and water, and mitigate lands currently impacted by salts. Salinity problems in the groundwater and soil are not prevalent in the Kings Basin, but the western side of the Basin does have noticeably higher salinity levels than the eastern end. Nevertheless, the region is participating in several programs to manage salinity and limit salt buildup in the soil, wastewater and groundwater. These measures include:

1. Participation in the Irrigated Lands Regulatory Program, which monitors salt contents in water supplies;
2. Encourage growers to use surface water over groundwater; and
3. Educational materials prepared by the City of Fresno on how to reduce salt pollution from daily urban activities;
4. Participation in the Central Valley Salts Coalition.

6.5.6 Urban Runoff Management

Urban Runoff Facilities

Urban runoff management is a broad series of activities to manage both storm water and dry weather runoff. Dry weather runoff occurs when, for example, excess landscape irrigation water flows to the storm drain. Urban runoff management has the primary goal of preventing damage from stormwater or urban water used but should also consider multiple purposes such as water supply and habitat enhancement. Increased urbanization also may result in increased paved areas and runoff. This serves to change the local conditions and may affect groundwater recharge of natural precipitation. Consequently, including

groundwater recharge as part of stormwater management is considered very important in the Kings Basin.

The FMFCD manages urban runoff in a large portion of the urban area in the Kings Basin. Several other cities and districts also provide urban runoff management. The Cities of Fresno and Clovis, through FMFCD and with the assistance of FID, capture stormwater through joint-use facilities designed for both flood control and groundwater recharge. Some recharge/retention ponds also provide recreational benefits. The Fresno and Clovis General Plans, FMFCD Service Plan, and FID policies provide good examples of how recharge/retention ponds and canal facilities can be integrated to meet multiple objectives. FMFCD's urban drainage basins are considered a regional Low Impact Development (LID) measure in the State's Water Plan.

6.6 Improve Flood Management

6.6.1 Flood Risk Management

Flood risk management is a strategy that assists individuals and communities in managing flood flows to prepare for, respond to, and recover from a flood. Some examples of flood risk management include levees, floodwalls, floodplain zoning, floodplain function restoration, disaster preparedness, and flood emergency response.

FMFCD manages floodwaters in a large portion of the urban area in the Kings Basin and KRCD manages the Pine Flat Dam and numerous levees along the Kings River. The Kings River is the major hydrologic features in the region that poses a flood risk. In addition, there are several smaller streams, creeks and sloughs in the Kings Basin. Flood risk management is important since many floodplain areas are developed with cropland or infrastructure. An existing levee system, maintained by KRCD, protects primarily rural agricultural lands along the Kings River. Other strategies for improving flood protection that supply both flood control and water supply benefits include recharge basins, off-channel reservoirs, and flood control basins. Climate change could increase the severity and intensity of flooding, necessitating prudent monitoring for changes in flooding, and intensive floodplain protection and management.

6.7 Practice Resource Stewardship

6.7.1 Agricultural Lands Stewardship

Agricultural lands stewardship broadly means the conservation of natural resources and protection of the environment on agricultural land. Land managers practice stewardship by conserving and improving land for food, fiber and bio-fuel production, as well as watershed functions, soil, air, energy, plant and animal and other conservation purposes. Agricultural land stewardship also protects open space and the traditional characteristics of rural communities. As more land becomes developed in the Kings Basin, agricultural land will be increasingly relied on for flood control, water conservation, habitat preservation, and carbon sequestration, while maintaining ongoing production of crops.

Some agricultural land stewardship examples include wind breaks, noxious weed control, riparian buffers, cover crops, composting, fish friendly farming, and creation of wetland reserves.

Examples of agricultural land stewardship in the Kings Basin include the Terranova project, and managed grazing at Big Dry Creek and Fancher Creek. Constraints to developing these types of projects include funding, financial incentives for landowners, landowner interest and recognition of benefits, and regulatory barriers.

6.7.2 Ecosystem Restoration

Ecosystem restoration focuses on restoration of aquatic, riparian and floodplain ecosystems because they are the natural systems most directly affected by water and flood management actions and are likely to be affected by climate change. Examples of ecosystem restoration include curtailing waste flows into natural water bodies, reducing barriers to fish migration, meadow restoration, native plant preservation, and restoring wetlands. Ecosystem restoration can also be directly incorporated into engineered projects, such as groundwater recharge basins. These types of projects are often done in collaboration with government agencies or non-governmental organizations.

Local Wildlife

The Authority recognizes the importance of ecosystem restoration to protect water rights, improve water quality, provide flood protection, and increase public support for water projects. Examples of ecosystem restoration in the Kings Basin include the Kings River Fisheries Management Program, Coehlo and Gragnani Wetlands Restoration Project (through the USDA Wetlands Reserve Program), and the FMFCD Rural Streams Program. Constraints to developing ecosystem restoration projects include funding, high land costs in some areas, feasibility of integrating restoration elements into proposed projects, regulatory constraints, political acceptance, weed control when near agricultural lands, and concerns for spillover of endangered species onto adjoining lands.

6.7.3 Forest Management

Forests in California are used for sustainable production of resources such as water, timber, native vegetation, fish, wildlife, and livestock, as well as outdoor recreation. The economic value of water produced by forests equals or exceeds that of any other forest resource (CWP 2009 update). Almost all forest management activities can affect water quantity and quality. This strategy focuses on those forest management activities that are designed to improve the availability and quality of water for downstream users. Some forest management strategies include meadow restoration to regulate stream flows, abandoned mine reclamation, forest fire management, and

Sequoia National Forest

ecosystem restoration. A regional example is the Big Meadows Improvement Project completed in 2007 in Sequoia National Forest.

There is little forest in the IRWMP area, but the Kings River watershed is largely forested. Most of the forest land is managed by the National Forest Service. The Authority therefore is not directly involved in forest management but can assist and facilitate these efforts through the following: 1) Communicate with local watershed organizations; 2) Write letters of support for forest management projects; 3) Collaborate with neighboring IRWMP groups in the Sierra Nevada Mountains.

6.7.4 Land Use Planning and Management

Integrating land use and water management should consider planning for housing and economic development needs of a growing population while providing for the efficient use of water and preservation of water quality. The way we use land – the pattern and types of land use, transportation and level of intensity – has a direct relationship to water supply and quality, flood management, and other water issues. For example, land use planners could require xeriscape to reduce water demands, or permeable pavement to reduce flood risks.

Previously, planning for land use and water supplies was conducted by different agencies, at different times, for different planning horizons, often using different methodologies, assumptions, and data. This resulted in inconsistencies in the plans, poor coordination of public investments, and subjected agencies to legal challenges. Some local land use plans do not address, or only acknowledge, regional water issues, such as overdraft. Consequently, integrating land and water use planning is an important goal in the Kings Basin.

In 1996, the federal Safe Drinking Water Act issued a requirement for states to provide Technical, Managerial and Financial (TMF) capacity requirements for public water system operations to ensure sustainability and long-term compliance with drinking water standards. California put forth Section 116540 of the California Health and Safety Code (CHSC) in response to the federal requirements, which applies TMF criteria to community water systems as well as non-community water systems and water systems changing ownership or seeking funding from the State. The CHSC section reads:

> *"No public water system that was not in existence on January 1, 1998, shall be granted a permit unless the system demonstrates to the department that the water supplier possesses adequate financial, managerial, and technical capability to assure the delivery of pure, wholesome, and potable drinking water. This section shall also apply to any change of ownership of a public water system that occurs after January 1, 1998."*

The DDW has a TMF criteria document and assessment form available on their website, which the local land use agencies are able to use to facilitate compliance with the TMF requirements for new water system or those undergoing facility improvements.

The Authority and IRWMP process provide an ideal opportunity to integrate land and water supply planning. The Authority has addressed this topic with the formation of a Land Use and Water Supply Work Group and land use planning workshops held in 2007. Relation to Local Water Planning and Relation to Local Land-use Planning are discussed in more detail in Chapters 13 and 14, respectively.

6.7.5 Recharge Area Protection

Protection of recharge areas is based on two primary goals: 1) ensure that areas suitable for recharge are protected from development into urban infrastructure; and 2) preventing pollutants from entering groundwater to avoid expensive treatment that may be needed prior to potable, agricultural, or industrial uses. Recharge area protection has high importance since it is necessary to develop groundwater recharge and banking projects, which were identified as the most important strategy for the region.

Local city and county land use agencies can apply their land use authorities and develop policies to protect recharge areas or require mitigation for groundwater impacts associated with new development. Agencies can also develop cash reserves or other options to acquire prime lands quickly from willing sellers when they are available on the market. High land costs, lack of readily available capital, and inability to rapidly act when land is on the market are constraints to protecting prime recharge areas.

The Fresno County General Plan has policies that encourage development of retention-recharge basins. The General Plan policies of the Cities of Clovis and Fresno also seek to preserve recharge areas for use as recharge/retention ponds. In addition, the FMFCD purchases land in areas slated for development in order to build both recharge and retention ponds. As part of the IRWMP feasibility analysis, favorable recharge areas have been mapped in the region (see Kings Basin Conjunctive Use Feasibility Analysis by WRIME, 2006). In addition, prime recharge areas are often locally mapped by cities or irrigation districts.

6.7.6 Sediment Management

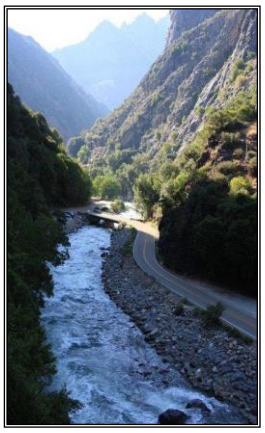
Floods have a major role in transporting and depositing unconsolidated sediment onto floodplains. Erosion and deposition help in determining the shape of a floodplain, the depth and composition of soils, the quality of river habitats, and the type and density of vegetation. Disruption of the dynamics of natural sediment transport can cause failure of adjacent levees through increased erosion or can reduce the flood-carrying capacity of natural channels through increased sedimentation. Sediment is a major component of alluvial fan and debris-flow flooding.

Sediment management, as it relates to the region is primarily affected by the sediment management of the Kings River watershed. The Authority therefore is not directly involved in sediment management but can assist and facilitate these efforts through communication and coordination with neighboring IRWMP groups and watershed organizations.

Related to climate change, there is increased risks for flooding due to changes in the quantity and timing of runoff from snow melt in the Sierra. Increased sedimentation in reservoirs can create water supply and quality concerns of surface water supply users in the region. Additionally, increased flooding can cause loss of valuable soil critical to maintaining the agricultural productivity throughout the region. The IRWMP acknowledges these challenges and will seek opportunities to incorporate project elements to mitigate them.

6.7.7 Watershed Management

Watershed management is the process of evaluating, planning, managing, restoring, and organizing land and other resource uses within an area of land that has a single common drainage point. This strategy is important for maintaining good water quality and a healthy ecosystem. In the upper part of the Kings River watershed, above Pine Flat Reservoir, a number of watershed planning efforts are occurring through the Resource Conservation Districts and National Forest Service. Other watershed management programs are implemented by non-governmental organizations. One example is the El Rio Reyes Conservation, a regional California land trust whose mission is to safeguard the Kings River and its lands for future generations. The Trust believes the best way to accomplish this task is to conserve open space and riparian habitat and provide means to ensure the viability of the farms surrounding the river. The IRWMP acknowledges these existing programs, seeks opportunities to coordinate efforts, and when appropriate, write letters of support for funding projects.



Kings River Watershed

6.8 People & Water

6.8.1 Economic Incentives (Loans, Grants and Water Pricing)

Economic incentives include financial assistance, water pricing, and water market policies intended to influence water management. Examples of economic incentives include low interest loans, grants, free services, rebates, and water rate structures. Economic incentives can influence the amount of use, time of use, wastewater volume, and source of supply. Economic incentives can also produce environmental and social benefits and avoid or delay construction of new facilities.

Economic incentives are prevalent throughout the Kings Basin, although they vary by agency. Some specific incentives include: tiered pricing, metering, rebate programs for installing conservation devices, and discounted prices for recycled water. KRCD and KRWA are administering a large incentive program for agriculture called the Agricultural Water Enhancement Program (AWEP). AWEP is a voluntary conservation initiative that provides financial and technical assistance to implement for projects that conserve water and improve water quality. Funding for the program includes $14 million over a 5-year

period. As of early 2012, 8,648 acres were awarded funds to help convert flood irrigation to micro-sprinkler irrigation.

6.8.2 Outreach and Engagement

Outreach and engagement in the region refers to the use of technology, tools and practices to facilitate involvement and contributions by the public, both individuals and groups, in water management. These contributions can be in support of water system projects, efforts to block water system projects and utilize legal, technical and community-based tools.

The Authority takes an active role in outreaching to the public constituency including open invitations for involvement in the Authority, Disadvantage Community engagements, college and school-aged information campaigns, accessible Advisory Committee and Board meetings, and partnerships with community-based organizations in the area.

The benefits of this approach in the region include a broader understanding of various perspectives on the implementation of water management projects, both physical and operational, and how to improve the management strategies to benefit more groups in the region.

6.8.3 Water and Culture

The use of water is intrinsically connected to the culture of people throughout our society, including Native American Tribes. While there are no Native American Tribes within the region, the management of water supplies effects the culture of the people in the region. There are several activities the CWP cites as being related to cultural impacts of water management, including:

- Subsistence such as fishing, hunting and gathering activities;
- Recreational such as motorized and non-motorized sports, camping, picnicking, etc;
- Spiritual including baptisms, weddings, ceremonies and blessings;
- Historic Preservation including maintaining historic sites, buildings, and places;
- Public Art; and
- Lifeways

Protecting the relationship between culture and water management is achieved throughout the Kings Basin through the Kings River Fisheries Management Program, compliance with the California Environmental Quality Act's cultural requirements, outreach and engagement activities (described above) and involvement of multiple Members and Interested Parties in project implementation.

6.8.4 Water-Dependent Recreation

Recreation and public access include the management of lands and water resources by local, state, and federal public agencies under an implied principle of public trust responsibility. As trustee to public resources, the state and federal agencies must consider the benefit and use of land and water resources for recreational opportunities. Natural resource values often define the character and aesthetic appeal of water-dependent recreation, making it desirable and interesting to visitors. However, poorly planned use, misuse, or overuse of any recreation resource can degrade natural resource values and recreational experiences.

Providing public recreation benefits and planning to integrate benefits into projects may increase public approval. In other words, if a project provides recreational opportunities, the public may be more supportive of the project overall thus helping to protect its water supply benefits. Climate change could modify hydrologic patterns and impact existing recreational opportunities. An adaptive management philosophy is needed by recreational facility managers so that opportunities remain available.

Recreational opportunities are provided throughout the Kings Basin at water resources facilities including reservoirs, along the Kings River corridor, and in some flood control basins. Where cost effective and feasible, recreational elements should be included in new facilities in order to provide multiple benefits. Cost, timing, liability, and other issues may constrain the ability to integrate recreational benefits into water resources projects.

6.9 Other Strategies

6.9.1 Crop Idling for Water Transfers

Crop idling for water transfers is removal of lands from irrigation so the water supply can be transferred to other lands. The strategy is a temporary measure and the idled land would be returned to irrigation at a later time. Crop idling is not the same as idling lands with the intent to improve soil and crop sustainability and productivity (i.e. crop rotation).

Local Crops

Benefits from crop idling include payment to farmers who sell their water supply, and redistribution of water to another area that needs it. The payments could be used for on farm-related investments, or to develop water conservation measures. Costs include loss of crop production and annual costs to manage the land to avoid negative impacts, such as weed spreading. Loss of crop production can have numerous socio-economic impacts on local communities. Crop idling is not feasible with permanent crops, which comprise much of the farmland in the Kings Basin.

Crop idling is sometimes practiced within irrigation and water districts. Some districts allow growers to fallow their land for a season and sell the water to another grower in the same district. Crop idling is not currently performed on a regional scale between different water agencies due to legal issues regarding water transfers, and some public opposition to transferring water out of their service area. However, this strategy could have some benefit, especially with canal company stock used in the Kings County Water District, a special type of water right that does not have defined place-of-use boundaries.

6.9.2 Dew vaporation

Dew vaporation is a specific process of humidification-dehumidification desalination. Brackish water is evaporated by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall. Since there are no saline or brackish water supplies in the Kings Basin this strategy is not applicable.

6.9.3 Fog Collection

Fog collection involves collecting fog on a fine mesh or array of parallel wires that drips into collection containers. There has been some interest in fog collection for domestic water supply in dry coastal areas that have frequent fog. Because of its relatively small production, fog collection is limited to producing domestic water where little other viable water sources are available. Fog collection has not yet been used as a water source in California. Some areas in the Kings Basin receive dense fog. However, the fog is sporadic and typically occurs in winter months when water demands are low. Therefore, this strategy is not applicable to the Kings Basin.

6.9.4 Irrigated Land Retirement

Irrigated land retirement is the removal of farmland from irrigated agriculture to provide water supplies elsewhere and/or take unproductive land out of production. Land retirement can enhance water reliability by making water available for redistribution. Land use changes from land retirement can impact neighboring lands, such as through the spread of weeds or wildlife. In addition, retiring land can have large socioeconomic impacts on local community including loss of jobs and income. However, retired land can be converted to other uses with low water demands such as grazing, solar farms, wildlife habitat, etc., which could offset some of the socioeconomic impacts. Costs for retiring land include the price of land and the annual cost of managing the land to avoid environmental impacts. Land retirement should only be performed on a voluntary basis. When retiring lands the highest priority should be given to lands with poor quality, low productivity, and land management problems, such as poor drainage of irrigation waters.

Climate change may reduce water supplies or increase water demands, resulting in a greater need to retire lands. Climate change could also impact water quality leading to increased salinity buildup in certain lands, providing a higher incentive to retire the lands. Land retirement would still be a suitable alternative if the climate changes, but some

impacts, such as wildlife or weed spreading may differ from historical retirement programs.

No permanent land retirement has been performed in the Kings Basin. However, permanent land retirement was implemented in the neighboring Westlands Water District, located west of the Kings Basin. Most of the retired lands had serious drainage problems. Their program was implemented as a last resort to address chronic water shortage and drainage problems, but it has successfully retired thousands of acres and increased water reliability for other landowners. The Authority believes that land retirement can be an effective method to reduce water demands and increase water reliability for other uses. Lands that may be candidates for land retirement are those with no surface water supply or no infrastructure to use surface water. However, it is considered a measure of last resort and the other resource management strategies, especially floodwater capture, should be further developed before land retirement is considered.

6.9.5 Rainfed Agriculture

Rainfed agriculture is the practice of providing all crop consumptive use directly by rainfall. Due to the unpredictability of rainfall frequency, duration, and amount, there is significant uncertainty and risk in relying solely on rainfed agriculture. However, rainfed agriculture is practiced in the Kings Basin. Some growers plant crops such as winter wheat and safflower that can be watered entirely by rainfall during the rainy season. However, some winter crops have been planted and subsequently lost during dry years. Rainfed agriculture is less risky if the growers have the option to apply irrigation water as an emergency measure. Due to the inherent risks with rainfed agriculture, it probably has little potential for increased use. Climate change has the potential to change precipitation patterns which may benefit or adversely impact rainfed agriculture. According to the 2009 California Water Plan update, water supply improvements using rainfed agriculture will require development of new varieties of plants, and new and innovative soil and water management.

6.9.6 Waterbag Transport

Waterbag transport involves diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them to an alternate coastal region. This strategy is not currently being used in California and would likely have high costs and extensive permitting requirements. The Kings Basin is roughly 100 miles to the coast and water delivered by waterbags would need to be conveyed directly to the region or through complex exchanges. Transporting the bladders by rail has also been proposed, but this would also be costly and only limited quantities could be transported on a bladder that fit on rail cars. Due to its high cost, difficulty in permitting, and difficulty conveying the water to the Kings Basin, this alternative is not considered feasible.

6.9.7 Drought Planning

The Department of Water Resources (DWR) resource management strategies did not include drought planning. In recognition that a drought is a regular occurrence in the Kings Basin and will likely occur with increasing frequency due to climate change, the Authority decided to include drought planning as a resource management strategy. The Kings Basin has a productive groundwater supply that can be used as a reserve supply in droughts. However, during droughts, impacts can still be felt from higher water costs, declining groundwater levels, higher groundwater pumping costs, and in a prolonged drought, some wells can go dry. Water users that rely primarily or solely on surface water are the most impacted in droughts.

In the Kings Basin, the most appropriate response to drought planning is to develop conjunctive use and groundwater banking projects that reduce overdraft and capture wet year water for storage in the groundwater basin. Statewide droughts can present opportunities for the region if groundwater banks are developed to store water for third parties. These can increase revenue for local agencies and would likely include a small water supply benefit for the water bank owner.

Drought-stricken Crops

Many local agencies have drought response plans. However, the Kings Basin does not have a regional drought response plan. Such a plan would need to identify participants and their responsibilities, develop a drought monitoring plan, and develop drought response measures. There is currently no adopted hydrologic index and no standard definition of a drought in the Kings Basin. The development of drought index to characterize hydrologic year types and define drought conditions is needed. A regional drought response plan would help to better characterize drought conditions and allow water users to pool and share their water resources and help to minimize regional impacts.

6.10 Application of RMS to Climate Change

Implementation of the RMS discussed above will have positive effects on how the region responds to climate change. For example, reducing water demand, either through agricultural or urban water use efficiency will result in reduced energy consumption and reductions in greenhouse gas (GHG) emissions. These strategies will ultimately be helpful in responding to vulnerabilities identified in the vulnerability assessment discussed in Chapter 17, as related to climate change. The following table lists the RMS considered for the region that relate to climate change.

Table 6-2: Application of RMS to Climate Change

Strategy	Response to Climate Change	Reduces Energy Consumption and GHG Emissions	Reduces Climate Change Vulnerabilities
Reduce Water Demand			
Agricultural water use efficiency	X	X	X
Urban water use efficiency	X	X	X
Improve Operational Efficiency and Transfers			
Conveyance - regional/local	X		X
System reoperation			X
Water transfers			X
Increase Water Supply			
Conjunctive management and groundwater			X
Recycled municipal water		X	X
Surface storage – Regional/Local	X		X
Improve Water Quality			
Drinking water treatment and distribution			X
Groundwater / Aquifer remediation			X
Matching quality to use			X
Urban stormwater runoff management	X		X
Improve Flood Management			
Flood risk management	X		
Practice Resource Stewardship			
Forest management			X
Land use planning and management	X		X
Recharge area protection	X		X
People & Water			
Outreach and Engagement		X	
Other Strategies			
Crop idling for water transfers	X		X
Drought planning	X		X

7 PROJECT REVIEW PROCESS

This section has been developed to document and provide an update to the Authority's Project Review process. The Kings Basin Water Authority's (Authority) project review process and procedure was first identified in the 2007 Integrated Regional Water Management Plan (IRWMP) and was later updated by action of the Authority's Board on October 10, 2007. In review and consideration of the 2016 IRWM Guidelines, some modifications to the process have been developed to fully address the guidelines. The process for developing the region's project list involves two primary steps:

1. Identification of projects to implement the IRWMP
2. Project prioritization related to specific grant opportunities

This section describes the project review process and is adopted by the Authority's Board by adoption of this IRWMP. The process developed includes the procedure for:

- Submitting a project to the IRWMP
- Review of projects to implement the IRWMP
- Communicating the list of selected projects to the KBWA

Because of the continual efforts by Members and Interested Parties to develop new projects and further refine existing projects, new and revised projects are considered and approved by the Board on a quarterly basis and the Board includes the project list in its Annual Report.

7.1 Identification of Projects

Identification of projects is open to all stakeholders within the region. The Authority has encouraged inclusion of all types of projects and programs provided they address at least one of the IRWMP's measurable objectives that conform to at least one of the regional goals. As stated in Chapter 5, the regional goals are the broadest statement of intent or purpose for the IRWMP and are intended to address the primary problems and resource conflicts in the region. The coequal goals of the IRWMP are to:

- Halt, and ultimately reverse, the current overdraft and provide for sustainable management of surface and groundwater;
- Increase the water supply reliability, enhance operational flexibility, and reduce system constraints;
- Improve and protect water quality;
- Provide additional flood protection; and
- Protect and enhance aquatic ecosystems and wildlife habitat.

The following three step quarterly process has been developed for identification of projects to implement the objectives of the IRWMP. The process is completed each quarter and the project list included as part of the Authority's annual report.

Step 1. Call for Projects

The Authority releases a Call for Projects by email to all members, interested parties and stakeholders at least once per year. The request is also announced at Advisory Committee and Board Meetings and posted on the Authority's website. Project proponents are asked to complete a Project Information Form that can be submitted to the Authority by email, mail, facsimile, or through the Authority's website tool. The Project Information Form will typically include the following information:

- Project Name
- Project Proponent(s)
- Project Location
- Project Size
- Project Status (Conceptual, Planning, Feasibility Study, Preliminary Design)
- Background description of the project (or project need if conceptual)
- Project Workplan
- What is the primary IRWMP Regional Goal (RG) that applies to this project and how does the project help meet that objective?
- Identify any other IRWMP RG that applies to the project? How the project will help meet those objectives.
- What is the primary IRWMP Measurable Objective (MO) that applies to this project and how does the project help meet that objective?
- Identify any other IRWMP MO that applies to the project? How the project will help meet those objectives.
- Which Resource Management Strategies the project is related to and how.
- Technical feasibility of the project
- Project costs and financing
- Does the project provide specific benefits to critical disadvantaged community (DAC) water issue? If so, how and are there any Environmental Justice concerns?
- Economic feasibility, including water quality and water supply benefits and other expected benefits and costs
- Contribution of the project to in adapting to the effects of climate change in the region
- Contribution of the project in reducing GHG emissions as compared to project alternatives
- Whether the project proponent has adopted or will adopt the IRWMP

The Authority may add to or modify the form and the information requested. Although a specific request is made each year prior to the annual report preparation, a project can be added to the project list at any time throughout the year. The process is open to all projects regardless of the current status. Projects still at a conceptual level are encouraged to be added to the list, as inclusion of conceptual projects is intended to help prevent duplication and help foster project integration and development discussion amongst stakeholders in the region. All projects must be submitted by either an Interested Party or Member. Interested Parties must seek sponsorship of their projects from one or

more Members in order to be considered for funding. Interested Parties do not need to have secured Member sponsorship prior to submitting for Project List inclusion.

Step 2. Review by Project Workgroup

The Project Workgroup is defined in Chapter 2 as an active workgroup, who receives all of the Project Information Forms and reviews each submitted form for content and consistency. The Workgroup confirms the accuracy and reasonableness of the submitted project information. If necessary, the Workgroup will clarify project information with the project proponent(s). During this step in the process, the Project Workgroup also considers and recommends possible project integration, regional applications, multiple benefits, and other strategic project efforts that could benefit the IRWM Objectives. A project list is generated in which projects are identified based on the primary IRWMP RG and MO that they will meet, as well as additional IRWMP RG and MO that apply.

Step 3. Project list included in Annual Report

Upon completion of the Project Workgroup review, the project list is reviewed and finalized and included into the Annual Report. The completion of the annual report is subject to other factors included in the report, such as the availability of groundwater monitoring data. The Annual Report, including project list is approved by the Authority Board, who has the authority to reprioritize or modify the project list. The completed project list is also made available to all stakeholders and is posted and available on the Authority's website.

After completion of the project list each year, as new projects are brought forth by Members and Interested Parties, the Authority requests the project information form for those new projects and maintains the submitted project information until the annual list of projects is updated. The Annual Report will also include an update as to completed projects.

7.2 Project Prioritization

While the Project List is continually being added to, and an updated list adopted annually, there is need for project prioritization when specific grant opportunities arise. The Authority has developed the following eight step process for project prioritization based on funding opportunities.

Step 1. Presentation of Funding Opportunity Information

In addition to IRWM specific funding opportunities, the Authority considers other funding opportunities. Funding opportunity information is brought to the Authority by members, interested parties, consultants and other stakeholders. With many opportunities, it is important that a basic understanding of the opportunity, project eligibility and selection criteria is disseminated within the region. These opportunities come from a variety of sources for a wide range of projects and programs. The Authority, through its active and regular meetings, communication and website, offers an arena for communication of

these opportunities. At its regular Advisory Committee and Board meetings, funding opportunities from various sources are presented to all participants and are communicated to the region through meeting minutes available on the Authority website as well as via direct email.

Step 2. Establish Project Selection Panel (Panel)

Upon the decision to consider specific IRWM and other grant opportunities that require project prioritization, a Panel is selected by the Project Workgroup. The Panel shall have at least three individuals (Members or Interested Parties) and no more than 7 individuals. The Panel works with Authority staff and others as needed to develop a Project Information Request that is tailored to the specific funding opportunity and a template form is developed. The template form also includes a scoring matrix based on the information required. The scoring matrix typically matches that of the funding opportunity, with the addition of other categories considered for prioritization including consideration to improve baseline conditions in areas of the region. At a minimum, the project information request form will include:

- Grant specific requirements
- Project Sponsor
- List of each applicable IRWMP Measurable Objective, how the project applies, and a description or estimate of the benefit
- Current project status and detailed schedule for completion
- Workplan
- Technical feasibility
- Economic feasibility
- Funding of local cost share (if required)
- Climate change and Greenhouse Gas (GHG) reducing considerations

Step 3. Project Information Request

The Panel provides information regarding the grant to Members and Interested Parties. An email announcement will be made, and typically a portion of an Advisory Committee meeting or if needed a separate workshop will be held to educate project proponents of the funding requirements and template form to be submitted. The template form is provided to the potential applicants and a submittal deadline is established. The forms can be submitted by email, mail, hand delivered, or through the Authority's web site. The form and deadline are posted on the Authority's website.

Step 4. Project Prioritization by Panel

After the deadline, the Panel is provided copies of the forms submitted for each project. The Panel members then individually score each project. After scoring each project, the Panel meets to review the scores and provide a prioritized project list based on the scoring. The Panel then presents the prioritized list to the Authority. This can be done by email notification or through the Authority website and may also be presented at a separate meeting.

Step 5. Recommendation of Projects to be Included in Funding Application

The prioritized project list may include more projects or funding requested than is eligible or reasonable to submit for the specific funding opportunity. The Panel will consider and develop a recommended list of projects based on the prioritized scoring that should be included in the funding application request. It is possible that a highly prioritized project may not be able to proceed with the application or be initiated within the required timeframe. As part of this step, the Panel will then solicit confirmation from each of the recommended project proponents to ensure that they can proceed with additional efforts required to prepare the application and discuss possible mechanisms to assist with application preparation. An agreement for funding of the application process, contract legal review of funding master agreement and sub-agreements and funding agreement between member sponsors for interested parties (if necessary), will be developed amongst the applicants and included in the Advisory Committees final recommendation.

Step 6. Advisory Committee Recommendation

The Panel's recommendation, including the list of projects and funding source for application preparation will be presented to the Advisory Committee for discussion, consideration, and a recommendation to the Board.

Step 7. Board Approval

The Advisory Committee's recommendation will be presented to the Board, and the Board will make the final decision for approval of the projects to be included in the funding application.

Step 8. Funding Application Development and Submission

Following approval by the Board, the project proponents will complete the necessary information for the funding application preparation and submittal.

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8 IMPACTS AND BENEFITS

This section describes the general benefits and impacts from implementing the Kings Basin Integrated Regional Water Management Plan (IRWMP). Impacts were identified for both the local Kings Basin and surrounding IRWMP regions. Specific topics addressed include general benefits of regional water management, impacts/benefits of relevant resource management strategies, impacts/benefits to interested parties and disadvantaged communities (DACs), evaluation of impacts/benefits in project evaluation, and a plan for updating the impact/benefit analysis.

Identifying the impacts and benefits of implementing the IRWMP is important for the following reasons:

1. The impact/benefit analysis can be used to prioritize goals and resource management strategies.
2. Identifying adverse impacts from resource management strategies is important, since they are often overlooked by the more obvious benefits of the strategies.
3. The impact/benefit analysis can be used as a benchmark for evaluating IRWMP performance.

8.1 General Benefits of Regional Water Management

Historically, local management of the water resources, especially groundwater, was limited to independent operations by each overlying water agency and individual water users. If individual agencies and landowners continue to act individually, it is likely that competition and conflict will increase, groundwater overdraft will continue, and there will be increased risk for water quality impairment, land subsidence, litigation, and higher groundwater pumping costs. Regional water management replaces the local, fragmented approach with a more comprehensive and cooperative methodology. The key benefits of regional water management include:

- Development of a long-term vision for regional water management for water supply and water quality issues
- Management of water resources within a recognized hydrologic boundary rather than many isolated political boundaries
- Establishment of goals and policies for the most economical and efficient use of available water resources
- Reduced potential for conflicting goals/projects among those who share the same river and groundwater basin
- Forum for all parties to share ideas and information
- Effective management of overdraft in the Kings Groundwater Basin as a whole
- Improvement in local and regional water supply reliability
- Improved protection from drought
- Reduced costs of developing one regional plan versus individual agency plans

- In certain cases, reduced costs of developing regional projects rather than several smaller local projects
- Reduced dependence on imported water
- Increased operational flexibility of the water infrastructures in the region for common benefit
- Reduced potential for conflicts and litigation
- Protection and improvement of groundwater quality and implementation of regional water management strategies to implement solutions to address drinking water issues
- Shared development and use of same hydrologic model and analytical tools for project evaluation
- Reduced cost of data collection, data sharing, and data management
- Increased political influence needed to protect and preserve water resources
- Increased chances for obtaining state/federal grant funds as a region rather than as a local agency

These benefits would be lost if the IRWMP document is not maintained, the Kings Basin Water Authority (Authority) does not remain active, or the Authority members do not implement regional projects and programs.

A primary effect from not implementing the IRWMP would be continued groundwater overdraft and continued issues associated with long term water supply and water quality impacts, the largest water management problems in the region. This will result in the following impacts:

- Declining water levels
- Potential land subsidence
- Increased pumping costs
- Increased costs to lower pumps, deepen wells or construct new wells
- Potential conflicts between overlying water users for available groundwater supplies
- Loss of economic activity at the farm level
- Inability to respond to dry year conditions
- Reduced supply reliability
- Limitations on planned development and inability to comply with revised state laws requiring proof of adequate and sustainable water supplies.
- Inability of the basin to address regional water quality issues such as drinking water solutions for DACs

8.2 Impacts and Benefits of Resource Management Strategies

The screening level analysis of impacts and benefits from implementing 28 different resource management strategies are included in **Table 8-1**. These strategies come from a list of 31 resource management strategies listed in the California Water Plan Update

(DWR, 2013). Twenty-eight of those strategies were deemed applicable to the Kings Region and are discussed in detail in Chapter 6. The impacts and benefits of implementing the strategies broadly represent the potential benefits and impacts of implementing the IRWMP. **Table 8-1** was developed through interactive discussions by the IRWMP Update Work Group.

Table 8-1: Benefits and Impacts of Resource Management Strategies

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
Reduce Water Demand	Agricultural Water Efficiency	•Extend supply •Reduced cost •More efficient use of chemicals •Reduced subsurface drainage •Protection of water quality •Responds to climate change •Reduces energy consumption and greenhouse gases •Reduces climate change vulnerabilities	•Reduced groundwater recharge •Lost revenue if usage based •Causes operational changes •Irrigation hardware needed •Hardware maintenance •Irrigator training requirements	•More interregional basin exchanges possible •Reduced subsurface drainage	•Reduced supply to neighbors from spills and drainage
	Urban Water Efficiency	•Extend supply •Reduced cost •Reduced home chemical use •Delayed capital costs •Protection of water quality •Reduced energy use and greenhouse gases •Reduced groundwater overdraft •Reduction in green waste •Responds to climate change and reduces vulnerabilities	•Causes operational changes •Lost revenue if usage based •Inconvenient watering times •Creates hard demand that reduces opportunities for drought response	•More interregional basin exchanges possible •Reduced wastewater treatment •Reduction in urban runoff •Stretch existing water supplies	•Reduced supply to neighbors from wastewater effluent or runoff
Improve Operational Efficiency and	Conveyance - Regional/local	•Maintain water rights •Revenue generation •Conjunctive use •Improved water quality •Increased flood control capabilities •Deliver surface water to areas that use only groundwater •Responds to climate change •Reduces climate change vulnerabilities	•Increased use of facilities •Shortened maintenance periods •Greater costs for larger facilities		•Reduced flows to the Delta

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
Improve Operational Efficiency and Transfers	System Reoperation	•Water quality improvements •Flood protection •Recreation benefits •Power generation •Ecosystem restoration •Reduces climate change vulnerabilities	•Loss of historical supplies to other uses	•Temperature control for local fisheries •Flood protection •Ecosystem restoration •Litigation reduction	•Greater management requirements
	Water Transfers	•Efficient use of surface supplies •Revenue generation •Groundwater recharge •Agricultural sustainability •Reduces climate change vulnerabilities	•Loss of local water supplies •Groundwater mining •Environmental impacts	•Agency cooperation	•Inflated water prices •Environmental impacts
Increase Water Supply	Conjunctive Management & Groundwater Storage	•Dry year supply •Extends use of existing basin •Overdraft reduction •Improved water supply reliability •Groundwater recharge •Better groundwater management •Reduces climate change vulnerabilities	•Increased pumping costs compared to surface water •Litigation challenges •Increased data collection needs & costs •Uncertainty of impacts to facility neighbors •Facility capital costs •Land use changes for facilities	•Water quality improvement •Improved water supply reliability •Drought relief •Reduction in flood flows	•Water supply uncertainty if surplus flows diverted more frequently •Less flows to the Delta
	Precipitation Enhancement	•Quick project development •Increase in water supply •Power development	•Accuracy of location & timing		•Increase in supply in one area at the expense of downwind area •Added snow removal burden in some area •Public concern over accumulation of seeding agent

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
Increase Water Supply	Recycled Municipal Water	•Reliable supply •Improved water quality •Allows for development •Drought resistant supply •Reduces energy consumption and greenhouse gases •Reduces climate change vulnerabilities	•Increased operations & maintenance cost •Public acceptance •Water quality concerns with microbial contaminants, salinity, heavy metals, and pharmaceuticals	•Interregional exchange	
	Surface Storage - Regional/local	•Water supply reliability & augmentation •Flood control •Hydroelectric power generation •Recreation •Sediment transport management •Responds to climate change •Reduces climate change vulnerabilities	•Permitting requirements •Environmental mitigation •Cost •Limited sites available •Failure impacts •Beneficiary determination •Property tax losses •Habitat losses •Operational control	•Water transfers •Ecosystem management	•Reduction in downstream flows •Habitat migration
Improve Water Quality	Drinking Water Treatment & Distribution	•Protect public health •Maintain regulatory compliance •Reduces climate change vulnerabilities	•Increased O&M costs •Increasingly stringent regulations •Trained operators •Facility security •Treatment residual disposal •Deteriorating infrastructure •Reduce energy relative to groundwater pumping •Protects groundwater supply when used in-lieu of groundwater pumping	•Regionalization/ Consolidation of facilities	
	Groundwater Remediation/ Aquifer Remediation	•Protect public health •Maintain regulatory compliance •Avoided costs of purchasing additional supply •Reduces climate change vulnerabilities	•Costly •Highly trained operations staff •Public perception/acceptance of treated water	•Contaminant plumes kept from spreading	

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
Improve Water Quality	Matching Quality to Use	•Best use of available local water supplies •Most economical choice •Treatment avoided or limited •Reduces climate change vulnerabilities	•Possible environmental impacts •Infrastructure costs •Conveyance costs	•Upstream and downstream partnerships	•Water quality degradation •Effluent dominated streams •Salinity increases
	Pollution Prevention	•Improved water quality •Consistent with anti-degradation policies •More cost effective than "end of the pipe" treatment	•Increased regulations •Increased costs •Increased management needs •Increased monitoring costs	•Protect water at source •Agriculture irrigation	•Difficult to distinguish between level of impacts of natural and introduced contaminants at times •Lack of access to some recreational areas
	Salt and Salinity Management	•Increase longevity of irrigated lands •Protect water supplies •Postpone loss of beneficial uses	•Deep percolation required •Movement of salts from one area to another •Increased management	•Reduced avoided costs •Regional collaboration	•Economic impacts of lands are retired
	Urban Stormwater Runoff Management	•Water source for local recharge •Improve flood protection •Reduce surface water pollution •Minimize soil erosion & sedimentation problems •Local resource from waters historically lost to an area •Mimic natural hydrologic cycles •Responds to climate change •Reduces climate change vulnerabilities	•Cost to treat and manage runoff •Increased cost to urban developments •Disease from standing water in basins	•Regional collaboration and coordination	•Possible groundwater contamination from recharged water
Improve Flood Management	Flood Risk Management	•Enhanced flood protection •Reduce risk to lives & property •Recharge possible if captured •Riparian habitat improvements •Possibly restore floodplain function •Responds to climate change •Reduces climate change vulnerabilities	•Costly structural approaches •Permitting requirements •Long term ongoing maintenance of facilities •Emergency response planning required •Planning may limit development in some areas	•Reduce downstream flood risk •Reduce flood recovery costs •Manage upstream water •Regional planning required	•Planning may limit development in some areas •Revisions to flood insurance mapping

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
Practice Resources Stewardship	Agricultural Lands Stewardship	•Reduces pressure to agricultural lands from urban development •Increased economic viability for agricultural lands •Habitat improvement •Encourages agricultural practices which also benefit environmental and restoration concerns	•Conservation easement costs •Cost to implement BMPs	•Preservation of open spaces & agricultural land •Regional planning urban growth strategy •Flood impact reduction •Food security •Recreational opportunities	•Reduced tax base for county and state governments
	Ecosystem Restoration	•General quality of life increase •Protection and enhancement of fish & wildlife resources	•Increased short term costs to goods and services •Water supply loss	•Increased recreational opportunities •Increased diversity of native species •Natural water quality improvements •Sustainability to water and flood management projects	•Conflicting objectives in flood management •Opposition to conversion of farmland to habitat
	Forest Management	•Reduction in sedimentation in local rivers and streams •Water quality betterment via protection of land surface from erosion •Reduces climate change vulnerabilities	•Economic impacts to loggers and other forest users	•Air quality protection via fuel reduction •Water quality improvement •Winter snowpack improved with vegetation management •Recreational opportunities •Increased water storage in the watershed •Protection of water supplies •Reduced risk of fire spreading into area	•Reduction of carbon footprint

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
Practice Resources Stewardship	Land Use Planning and Management	•Improved communication among different agencies •Proper planning helps ensure new developments have reliable and sufficient water supplies •Potential for reduced water demands based on development designs •Opportunities to reduce flooding and increase recharge •Responds to climate change and reduces vulnerabilities	•Difficulty in getting some land and water use planners to cooperate •Increased costs to coordinate efforts	•Potential for reduced inter-regional conflicts	•Financial savings •Economy of scale by avoiding conflict •Overlaps of various interregional long-term plans
	Recharge Area Protection	•Provide sustainable and reliable water supply of good quality •Removal of some microbes and contaminants during recharge •Flood protection •Responds to climate change and reduces vulnerabilities	•Vectors and odors	•Prevention of pollutants entering groundwater	
	Watershed Management	•Community level solutions •Water quality improvement •Protection of local water rights •Flow attenuation	•Difficulty of diverse stakeholders working together	•Community collaboration •Flood mitigation •Quality of life •Habitat provision •Mineral/Nutrient cycling •Recreation opportunities	
People & Water	Economic Incentives (Loans, Grants, & Water Pricing)	•Decreased costs •Reduced wait for needed infrastructure •Reduction in water demand from water pricing structures	•Onerous application process •Increased federal or state directives in local issues •Increased administrative costs •Funding is intermittent	•Local return from statewide obtained funds •Societal goals obtained	•Increase in State debt burden •Social inequities
	Outreach and Engagement	•Protection of water quality •Reduced energy use and greenhouse gases •Reduced groundwater overdraft •Responds to climate change and reduces vulnerabilities	•Lost revenue if usage based •Public education and water-use awareness	•Protection of water quality •Stretch existing water supplies	•Improve water quality

Strategy		Kings Basin		Interregional	
		Benefits	Impacts	Benefits	Impacts
People & Water	Water and Culture	•Protection of water quality •Quality of life benefits to health	•Maintaining local community way of life		
	Water-Dependent Recreation	•Positive agency public relations •Revenue generation •Quality of life benefits to health	•Increased liabilities •Water quality degradation •Additional facility O&M costs •Lack of funding	•Recreational opportunities for travelers	
Other Strategies	Crop Idling for Water Transfers	•Drought water supply reliability •Stable farm income in water short years •Responds to climate change •Reduces climate change vulnerabilities	•Introduction of wildlife, weeds, pests and trash dumping to the area •Changes to local community way of life		•Local tax base losses •Changes in school populations
	Irrigated Land Retirement	•Generation of stable water supplies •Reduction in agricultural drainage to an area	•Taxpayer burden of land cost •Increased management costs of government owned retired lands •Lower income and higher unemployment		•Possible growth inducement via increased water supplies •Community/region may lose way of life/jobs •Local tax base losses •Changes in school populations
	Rainfed Agriculture	•Reduction in runoff with no-till systems	•Increased uncertainty of crop production •Low value of viable crops in historical irrigated agricultural areas •Increased runoff and erosion potential		
	Drought Planning	•Improved water reliability •Prevent loss of crops or crop idling •Responds to climate change •Reduces climate change vulnerabilities	•Costs to develop and maintain drought response plan •Implementing plan may be unpopular •Lack of funds for additional storage	•Lower regional groundwater overdraft •Lower demand for dry year water supplies	

8.3 Regional Benefits and Impacts

Identifying regional benefits and impacts is important since they are often ignored due to a focus on local benefits and impacts. Project proponents often look only within their political boundary and areas that provide their revenue. Recognition that projects affect other regions is a crucial step in developing effective inter-regional water management. The Kings Basin IRWMP may influence surrounding areas as described below. Refer to **Figure 3-5** for a map of the surrounding IRWMP organizations.

North – Madera Region IRWMP

The Madera Region IRWMP is located north of the Kings Basin. The Kings and Madera IRWMPs are separated by the San Joaquin River, which creates a partial hydrologic boundary, but the two regions are still hydrologically connected. Both the Madera and Kings regions are experiencing groundwater overdraft, and water management strategies that address or exacerbate overdraft would affect both regions. Both regions would also be affected by projects that impact the flow rate or water quality in the San Joaquin River.

South – Kaweah River Basin IRWMP and Tulare Lake Basin

The Kaweah River Basin IRWMP is located southeast of the Kings Basin IRWMP. These regions do not have significant hydrologic connection, except for some groundwater flow. IRWMP implementation in either region is believed to be relatively neutral in their effects on the other region.

The Tulare Lake Basin is located southwest of the Kings Basin IRWMP. This region is not currently covered by an IRWMP. Historically, Kings River flows flooded this area, but now this only occurs during very wet years. Consequently, flood control and diversion projects could negatively or positively impact the Tulare Lake Basin.

East – Southern Sierra IRWMP

The Southern Sierra IRWMP occupies lands to the east of the Kings Basin IRWMP. These lands are upstream and at higher elevation than the Kings Basin, so activities in the Kings Basin would not influence the Southern Sierra IRWMP. However, the Southern Sierra IRWM region includes the Kings Watershed, the primary water source for the Kings region and the Fresno County Stream Group, the upland watershed for the Fresno/Clovis metropolitan area. The Authority can provide support to and help coordinate forest management and watershed management in the Southern Sierra IRWMP area that benefits both regions.

West - Westside – San Joaquin IRWMP

The Westside – San Joaquin IRWMP is located on the western side of the Kings Basin. Major problems in this area include groundwater overdraft, surface water shortages, and soil salinity buildup. This area could benefit from Kings Basin projects that improve water quality that may flow to the west. This area would be impacted if Kings River flood flows are diverted in the Kings Basin, although the impacts could be positive (less downstream damage and flooding) or negative (less floodwater to divert for recharge or beneficial use). The Westside-San Joaquin region could also benefit from groundwater recharge efforts in the Kings Basin if groundwater flows westward.

8.4 Impacts and Benefits to Interested Parties, DACs and Tribes

The Authority has taken several steps to engage interested parties and DACs in the IRWMP development and implementation. Some local agencies, organizations and DACs are not full members of the Kings Basin Water Authority but can participate in a meaningful way as Interested Parties. Implementation of the IRWMP is expected to have the following benefits to DACs and Interested Parties:

- Discussion Forum. Provide a forum to discuss water management issues, concerns, and priorities, especially those important to DACs.
- Information Dissemination. Share information to which DACs or Interested Parties may not normally have access. For instance, DACs and Interested Parties may not have the staff to regularly track Department of Water Resources (DWR) grant projects or attend other regional or statewide meetings. This type of information it typically summarized for everyone's benefit at regular Advisory Committee meetings.
- Funding Opportunities. IRWMP members can apply for a variety of grant programs from DWR, including some that are specifically for IRWMP members. Interested Parties can also apply for these funds when they team with an IRWMP member that sponsors them.
- Special DAC Efforts. DACs can get greater recognition, publicity and input on their water resources issues through special DAC projects. One example is the DAC Outreach Pilot Study for the Kings Basin, which will identify critical water issues and potential projects in local DACs. Funding for this study was acquired by the Authority specifically for the benefit of local DACs. The study is overseen by a DAC Work Group that is part of the Authority and is frequently mentioned and discussed at Advisory Committee Meetings. The study results will also be incorporated into the IRWMP.

DACs and Interested Parties are not expected to bear any significant impacts from the IRWMP implementation, except local impacts that may occur from new projects. These impacts would require mitigation before the project is supported by the Authority (see Section 8.5).

The region does not contain any Native American Tribes; however, coordination with adjacent IRWMP organizations helps provide benefits to those communities.

8.5 Project Specific Impact/Benefit Analysis

The Authority requires that impacts and benefits from specific projects be evaluated through the California Environmental Quality Act (CEQA) or National Environmental Policy Act (NEPA) process. The Authority will generally not support projects that have adverse impacts unless a thorough mitigation plan is developed. Project impacts and benefits must be described when projects are submitted for funding consideration. Completion of the CEQA or NEPA process is not required during the project evaluation phase, but a thorough discussion of benefits and impacts is required. However, a complete and approved CEQA or NEPA analysis would be viewed more positively than a preliminary assessment since it provides greater assurance of project success.

As a minimum, the benefit/impact analysis should address the topics found in a CEQA analysis including: aesthetics, air quality, biological resources, cultural resources, geology and soils, hydrology and water quality, land use and planning, noise, population and housing, public serves and utilities, recreation, and transportation and circulation.

8.6 Revisions and Updates to Benefits and Impacts

The impacts and benefits of IRWMP implementation will be revised according to the following guidelines:

- Impacts and benefits will be reviewed and revised whenever the IRWMP is updated or DWR establishes new guidelines for this standard. It is expected that the IRWMP will be updated at least every 5 years.
- Impacts and benefits will be revised, as appropriate, to reflect anticipated or observed changes in the regional climate.
- Impacts and benefits will be revised to reflect lessons learned, or new impacts or benefits identified during implementation of local projects.

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9 PLAN PERFORMANCE AND MONITORING

This chapter describes several regional monitoring programs in the Kings Basin, procedures for monitoring progress in meeting the Integrated Regional Water Management Plan (IRWMP) objectives and implementing projects, guidelines for preparing project-specific monitoring plans, and applying adaptive management based on climate change impacts. The 2016 Guidelines also indicate monitoring in relation to benefits for Native American Tribal communities should be undertaken; however, as mentioned previously, there are no Native American Tribes within the IRWM region. In addition, an annual report is described which will include annual monitoring data and evaluations.

9.1 Regional Monitoring Efforts

Several regional monitoring efforts are performed in the Kings Basin. Each of these programs covers most or all of the Kings Basin and is described below.

Table 9-1: Regional Monitoring Programs

Irrigated Lands Regulatory Program *Lead Monitoring Agency: Kings River Conservation District* The IRWM region is covered by two coalitions The Southern San Joaquin Valley Water Quality Coalition via the Southern San Joaquin Valley MPEP Committee (Coalition) is a group of agencies formed to comply with the State's Irrigated Lands Regulatory Program (ILRP), which regulates discharges from agricultural lands. The coalitions are the Kings River Watershed Coalition Authority and the Kaweah Basin Water Quality Association. The Kings River Watershed Coalition Authority (KRWCA) is a joint powers agency formed by irrigation districts in the Kings River service area and administered through Kings River Conservation District. The KRWCA was formed in 2009 and includes over 4600 members and nearly 770,000 irrigated acres within the Tulare Lake Basin. The KRWCA covers the majority of the IRWM region. The Kaweah Basin Water Quality Association (KBWQA) is a third-party grower representative approved in 2014 and covering a small area within the IRWM region. The KBWQA region is predominantly south of the IRWM boundary. The coalitions monitor surface water (irrigation and stormwater) and prepares annual reports. In the future, the ILRP may require groundwater quality monitoring.	

Groundwater Level Monitoring

Lead Monitoring Agency: Kings River Conservation District

Kings River Conservation District (KRCD) publishes an annual groundwater report that includes regional groundwater contours (depth and elevation), and changes in groundwater storage for the Kings Basin. Current groundwater conditions are evaluated and compared to the past. The report uses data provided by several agencies on hundreds of wells. KRCD is also the lead agency for a local group that submits groundwater level data to the California State Groundwater Elevation Monitoring (CASGEM) program.

Surface Water Monitoring

Lead Monitoring Agencies: Kings River Water Association / Friant Water Authority

Kings River Water Association (KRWA) monitors surface water in the Kings River and its watershed including snowpack, reservoir stage, reservoir inflow and outflow, Kings River flows, and Kings River diversions. The Friant Water Authority monitors San Joaquin River water delivered through the Friant-Kern Canal.

Kings River Levee Monitoring

Lead Monitoring Agency: Kings River Conservation District

Since 1959, KRCD staff has worked to protect the flood carrying capacity of Kings River channels and levees. Maintenance efforts have focused on approximately 140 levee miles along the river. Flood control maintenance crew works to minimize and ultimately eliminate the danger of flood and erosion hazards. The crew controls weeds and brush along the levee banks and clears downed trees from the channels. KRCD conducts 24-hour patrols, surveys the levees, and monitors the levee banks for sloughing, erosion and boils.

Fisheries Monitoring *Lead Monitoring Agency: Kings River Water Association* The Kings River fisheries program monitors habitat conditions, stream flows, water quality, water temperature, hatchery planting programs, fish populations and movements, and macro-invertebrates within the lower Kings River and Pine Flat Reservoir.	
Land Subsidence Monitoring *Lead Monitoring Agency: Kings River Conservation District* As part of a coordinated effort to develop a Groundwater Management Plan, KRCD and several other agencies are identifying a network of benchmarks to track and evaluate for land subsidence. The program is still in the developmental stages and is expected to begin within a few years.	

9.2 Monitoring IRWMP Objectives

Each year the Authority will measure their success in meeting the IRWMP objectives. Each objective is listed in **Table 5-2** along with its metric and how it will be monitored. For example, for Objective No. 3: Identify Disadvantaged Community (DAC) Priority Needs, the Kings Basin Water Authority (Authority) will describe any studies or other efforts to identify water-related needs in disadvantaged communities. Also, for Objective No. 5: Increase Dry Year Supply, the Authority will document the amount of dry-year supply developed from new projects.

9.3 Monitoring Progress in Implementing Projects

The Authority will monitor progress in implementing projects. This will include projects sponsored by the Authority, and major projects performed independently by members and interested parties. Each year the following will be documented:

- List of projects approved for funding from Authority grant applications
- Description of new projects that are underway or completed and their anticipated benefits

9.4 Project-Specific Monitoring

Project monitoring is important to track the success and benefits of a project, ensure it is being operated properly, and to comply with laws and regulations. Examples of project-specific monitoring include monitoring water quality, groundwater depth, flood frequency, and effects a project may have on habitat or particular species. Project-specific monitoring is the responsibility of the agency(s) that are implementing a project and expect to directly benefit from the project. Applicable rules, laws and permit requirements are monitored during construction and operation as required. These agency(s) are also responsible for developing project monitoring plans.

The Authority requires draft monitoring plans for projects that are considered for funding. Final monitoring plans are prepared after final designs are completed and are typically approved by regulatory or funding agencies. Draft monitoring plans must include the following information when applicable:

General Information

- Project description
- Describe what is being monitored (water quality, water flows, etc.).
- Need for monitoring

Monitoring Program

- Monitoring frequency and schedule
- Overall monitoring time period (e.g. 5 years, life of project, etc.)
- Monitoring locations
- Monitoring protocols
- Monitoring tools and equipment
- Laws and regulations pertinent to monitoring
- Quality control procedures
- Applicable permit required monitoring

Data Management

- How monitoring data will be stored and tracked
- How monitoring data will be incorporated into Statewide databases
- Targets to be reached (if any)
- Measures to remedy or react to problems encountered during monitoring
- Reporting procedures

Other Topics

- Funding source for on-going monitoring
- Responsibilities (who will perform the monitoring)

9.5 Adaptive Management

The data gained through the previously discussed monitoring methods will be transmitted back to the Members and Interested Parties for their use in employing adaptive management. This information can be used by project proponents to adapt ongoing and future projects to meet the IRWMP objectives and address climate change effects. Additionally, the information will inform Members and Interested Parties to enable them to make recommendations for adjustments to the IRWMP, as discussed below in the Annual Report.

9.6 Reporting Procedures and Responsibilities

An Annual Report will be prepared to document the aforementioned monitoring efforts, an updated project list, proposed amendments to the IRWMP, and changes in governance, policies, and membership.

The Authority will assign a member of the Advisory Committee to oversee preparation of the Annual Report. The Authority may also use consultants to help prepare the report. Members and interested parties will need to contribute information on completed or on-going projects. Timely cooperation from the stakeholders is crucial to prepare an accurate and complete annual report. Below is a proposed outline for the Annual Report with a brief description of each section.

1 – Executive Summary

The executive summary will summarize the main points in the report. The executive summary will be written so it can be used for public outreach efforts such as press releases, newsletter articles, newspaper articles, etc.

2 - Physical Conditions

2.1 - Surface Water Hydrology

Summarize surface water data including reservoir storage, water diversions, and percent water allocation on the Kings and San Joaquin Rivers.

2.2 – Precipitation

Summarize data from local precipitation stations, snowpack volume, and departures from long-term averages.

2.3 - Groundwater Levels

Summarize groundwater level data from the KRCD Annual Groundwater Report including groundwater levels, groundwater depths, and changes in groundwater storage. Update graph summarizing long-term groundwater overdraft in the Kings Basin (See **Figure 12-1**).

2.4 - Water Quality

Summarize available groundwater quality data from local and regional studies and State databases. Due to the local and varied nature of water quality in the Kings Basin, focus on general changes in water quality and general conclusions provided in water quality studies.

3 - Success in Meeting Plan Objectives

Identify progress made by the Authority and local stakeholders in meeting each of the IRWMP's 14 objectives. Describe progress in terms of the metric provided for each objective (see Section 5.3).

4 - Implementation Projects

4.1 - Regional Studies

Describe regional water related studies performed by the Authority or other agencies such as KRCD, DWR, Department of Public Health, United States Geological Survey, etc.

4.2 - Project List

Solicit updated project data from the members and interested parties and store it in the Projects Database.

4.3 - Completed or On-going Projects

Describe the progress made on on-going and completed implementation projects.

4.4 - Grant Funding

Discuss grant funding that was applied for or awarded to the Authority.

4.5 - Lessons Learned

Document lessons learned from studies, project monitoring, or project implementation in the region that could affect regional goals; regional priorities, resource management strategies used, and project operations and monitoring.

5 - Proposed IRWMP Amendments

Document proposed amendments to the IRWMP. These differ from changes in governance or policy documented in Section 6 of the annual report. Any member or interested party can propose an amendment to the IRWMP. These proposed changes will be re-evaluated when the IRWMP is formally updated, which is expected to be about every five years.

6 – Governance, Policies and Membership

6.1 - Changes in Governance and Policies

Document changes in governance and policies that have been formally adopted by the Board of Directors.

6.2 - Changes in Regulations

Provide updates on regulations that may impact the Authority such as new requirements for IRWMPs, regional monitoring requirements for groundwater levels, etc.

6.3 - Changes in Members and Interested Parties

Document changes in the members and interested parties in the Authority.

6.4 - Coordination with Other IRWMPs

Document important coordination efforts with other IRWMPs.

The report will be based on the Kings River water year (October to September). Each year data collection will begin in October and the reported completed by the end of January.

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10 DATA MANAGEMENT

Data management processes and procedures within the region have been developed to ensure the efficient use of existing available data where applicable and provide accessibility to stakeholders within the region. This section describes the current data management processes and additional data needs within the region.

With the implementation of the Sustainable Groundwater Management Act (SGMA), the agencies and interested parties within the KBWA are now actively working within their various Groundwater Sustainability Agencies (GSA) to develop Data Management Systems (DMS) as required under the SGMA regulations. One common and consistent DMS is anticipated for each groundwater subbasin. The SGMA developed DMS will become the practical DMS for the region so the KBWA does not anticipate having its own separate DMS. The SGMA developed DMS are required to be completed and operational by January 2020.

10.1 Data Collection and Accessibility

Annual groundwater data collection and contour mapping are a primary focus within the region. Water level data is collected by several agencies within the region. A common protocol for groundwater data level collection has been developed. The groundwater level data is provided to Kings River Conservation District (KRCD) staff by Members and Interested Parties in a variety of formats, including hard copy notes, spreadsheet, database and Geographic Information Systems (GIS) data files. KRCD staff maintains a database of groundwater level data and produce contour maps. The Data Management System utilized by KRCD for groundwater data is a geodatabase that enables exporting to common formats such as spreadsheet or database files allowing local agencies and stakeholders to utilize the data.

KRCD staff submitted and was accepted as the local agency for submitting data to meet the requirements of SBx7-6 and California State Groundwater Elevation Monitoring (CASGEM). Local agencies perform their own quality assurance of the groundwater level data collection, and KRCD staff performs quality assurance on the data provided by the local entities by comparing to previous data collected and nearby data from other sources. Under SGMA, the GSAs are required to develop data quality control requirements that will be included the Groundwater Sustainability Plans to be completed by January 2020.

Surface water data is maintained within the region by the Kings River Water Association (KRWA) as well as the Friant Water Authority and local surface water purveyors who provide quality control measures for data collection in accordance with their policies and appropriate state and federal regulations. Daily readings are taken, and the surface water delivery data is provided in monthly and annual reports. The KRCD also serves as the lead agency for the region with the Kings River Water Quality Coalition (Coalition) which

was formed to comply with the Central Valley Regional Water Quality Control Board's Irrigated Lands Regulatory Program (ILRP). The Coalition collects surface water samples in accordance with the Surface Water Monitoring Plan and Quality Assurance Project Plan. The Coalition prepares an annual surface water monitoring report related to the ILRP requirements.

The development of the IGSM was a significant effort prior to the completion of the 2007 IRWMP and was critical in documenting the aquifer changes in the region over time. The region has adopted a policy regarding the use of the data contained within the model and how future updates or focused area considerations of the model are to be completed. Currently, the IGSM data is available to members who desire to utilize the data but updating and running the model requires an experienced technician familiar with the model type.

A project listing is also maintained by the Authority. The region currently uses a web-based tool for data entry regarding each project. A more detailed description of the project listing is provided in Chapter 7 – Project Review Process.

10.2 Data Needs

The Authority will continue to gather, collect and maintain data in formats that are easily compatible with other formats and usable within statewide systems. There are some additional data needs within the region, and the Authority will continue to work on methods to collect and maintain this data in an efficient and practical manner. These data needs include:

- Groundwater quality data collection within areas not served by a community water system remains a data gap within the region.
- Groundwater pumping data for agricultural and rural usage
- Priority project needs within Disadvantaged Communities
- Annual report information as described in Chapter 9 including:
    - Surface water hydrology
    - Groundwater levels
    - Water quality
    - Plan objective progress information
    - Project listing
    - Project status updates, benefits, and operational information

11 FINANCING

This section provides a general overview of potential funding sources, programs, and project partnerships available from federal, state, and local sources. The Kings Basin Water Authority (Authority) needs funding for operations, updating the Integrated Regional Water Management Plan (IRWMP), regional technical studies, preparing grant applications, project implementation, and project operation and maintenance.

The funding sources, agreements, and mechanisms will vary depending on the program or project, source of funds, how costs and benefits are distributed, and other political and economic variables. The development of new water supplies and the necessary infrastructure is a major financial undertaking that may require debt service.

The Kings River Conservation District (KRCD) staff tracks federal, state, and regional funding sources and keeps the Authority apprised of opportunities for grants, loans or other forms of assistance. A standing agenda item on funding sources will be used to brief the community.

Several administrative topics on Authority finances can be found in the Joint Powers Agreement (JPA) (**Appendix C**), including the fiscal year, fund and account management, property, bonds, budgets, and payments to the Authority. These topics are not discussed here, but additional details can be found in Article IV of the JPA.

11.1 General Funding Procedures

Funding for IRWMP Operations

The Authority's administrative and governance operations are funded by an annual payment made by each member. In 2018, the Authority had seventeen members and the annual payment was $7,000. The annual dues are re-evaluated and approved each year by the Authority Board. Interested parties are not required to make an annual payment. In 2018, new members were required to pay a one-time $30,000 fee to cover past planning investments, such as the IRWMP development. This payment can be amortized over multiple years. KRCD staff, and Authority members and interested parties also contribute in-kind costs by volunteering their time to attend advisory committee meetings, board meetings, committee and work group meetings, and participate in various administrative and governance projects. KRCD has also made direct monetary contributions to assist with the development of the authority and various governance tasks. However, KRCD may not be able to make these contributions in the future. The annual payments are expected to be collected as long as the Authority is active, thus ensuring some general funding to keep the Authority operating. There is a dilemma in collecting the funds necessary to prepare applications that benefit disadvantaged communities (DACs). Some DACs, especially small and severely DACs, lack the resources to cover the full cost of preparing funding applications. To date, a nominal

amount has been charged to some of these communities to cover application preparation costs. It is recommended that an approach be developed that will show commitment from beneficiaries, but not preclude the participation of the neediest communities in resolving their water issues.

Funding for Updating IRWMP

The IRWMP was originally drafted and updated using funds from Department of Water Resources (DWR) Proposition 50 and Proposition 84, respectively. The cost share for the IRWMP update was provided by in-kind salary costs for Members and Interested Parties. The IRWMA will seek DWR funds for future IRWMP updates, but realizes that these funds may not be available, or that their timing may not coincide with the appropriate time for an update. If DWR funding is not available, then updates could be funded through a combination of in-kind costs and fees collected from IRWMP members. The Authority plans to prepare annual reports documenting progress, data collected, changes to policies, etc. These annual reports will be the basis for any plan update and using them will reduce the cost of a full plan update.

Funding for Grant Applications

The Authority has submitted grant applications that benefit the entire IRWMP area and some that directly benefit one or more agency. Applications that benefit the entire Authority, such as for an IRWMP update or regional study will be funded with the Authority's general funds. Applications that directly benefit one or more agency will be funded by those agencies receiving the benefits. Requiring members to fund their own applications helps to ensure that they are serious and committed to their projects.

Funding for Project Development

Project development includes feasibility studies, design and construction. Federal, State and local funding are options for project development. Generally, these funds are only available to Authority members when the Authority submits a grant application. However, interested parties can apply for these funds as long as an Authority member sponsors them, or if an interested party partners on a project with a member. This policy helps interested parties and DACs to qualify for project funding. If for any reason a project proponent who was part of the final project package withdraws from funding, the Authority staff will discuss with the granting agency whether any funding will be withdrawn. Remaining funding will be split among remaining partners according to the default determination or negotiation option.

In October 2010, the Authority developed a Partial Grant Funding Split Policy (Policy No. UKB-001) that documents the default policy in case a grant award of less than 100% is received for a package including multiple projects. Unless otherwise agreed upon by the proponents, each project in the application will have their reward reduced by the percentage that the total grant award was decreased from the requested amount. For instance, if two projects requested $6 million and $4 million respectively, and only 80% of

the money is awarded, then each would receive 80% of their original request ($4.8 and $3.2 million, respectively).

The Policy also has the following "Project Drop-out Contingency" that states the following:

> "*If for any reason a project proponent who was part of the final project package withdraws from funding, the Authority staff will discuss with the granting agency whether any funding will be withdrawn. Remaining funding will be split among remaining partners according to the default determination or negotiation option*."

The Authority also has a 'Negotiation Option' that allows project proponents to negotiate a different split based on any rational or reasoning they think is appropriate. Any agreement must be acceptable to all parties whose award is affected and approved by the Authority Board of Directors

11.2 Federal Funding

Federal funds are available through a variety of mechanisms, including subsidies, appropriations, in-kind services, grants, loans, and cost-sharing agreements. These funding mechanisms are described below.

Legislative Approach

Federal funding can be secured through the legislative process to directly fund an approved project. A public agency working with a local congressional representative can initiate this process. The project may require the establishment of federal interest through an act of Congress (authorization) and then be funded in subsequent years (appropriation). An appropriation can be made the same year if the project is consistent with the Goals and Objectives of an existing federal program. Competition for congressional funds is formidable and requires broad support of local, regional, and state interests for projects to be successful in obtaining funding.

Federal Agency Interest

Funding can also be secured directly from federal agencies. Local projects may be eligible for funds and in-kind services through directed actions and partnerships. Federal agencies commit to projects during their respective internal budgeting processes and have the flexibility to disperse funding over several years. KRCD has secured funding in this way through several partnerships with the U.S. Bureau of Reclamation (USBR) and the U.S. Army Corps of Engineers (Corps).

Federal Assistance Programs

A third option is to apply for project funding under an existing federal agency grant, loan, or assistance program. Potential partnering agencies include the USBR, Corps, U.S. Environmental Protection Agency (EPA), U.S. Department of Agriculture (USDA), U.S.

Fish and Wildlife Service (USFWS), and U.S. Geological Survey (USGS). Eligibility, cost sharing, and application requirements vary among the programs.

11.3 State Funding

State funds are similar to the federal funding mechanisms and include legislations, state agency interest and state assistance programs.

Legislative Approach

Although the dollar amounts available from the state are usually not as substantial as federal funding opportunities, the state legislative process is somewhat more straightforward. Appropriating funds through the state legislature is extremely competitive and subject to the state budget conditions.

State Agency Interest

Discretionary funds may be available in the form of directed action assistance or in-kind services. Partnerships with agencies such as the DWR Division of Planning and Local Assistance (DPLA), Department of Fish and Game (DFG), and State Water Resources Control Board (SWRCB) may yield monies and services.

State Assistance Programs

A third option is to apply for project funding under an existing grant, low-interest loan, or assistance program administered by any of the various state agencies. In the past, propositions 13, 204, 50 and 84 have all provided substantial state-wide funds for water resources projects. Proposition 1 provides significant funds specifically for IRWMP updates and implementation projects and continues to be a source of funding through DWR. The state also has other funding programs that funds groundwater studies and monitoring. The State Water Resources Control Board (SWRCB) administers the Clean Water State Revolving Fund (SRF) program and Small Community Wastewater Grant programs that fund wastewater projects. The SWRCB, Division of Drinking Water (DDW) administers the Drinking Water SRF program as well as the Proposition 1 program to fund drinking water projects.

11.4 Local Funding

Local funding will vary by source and agency authority. City and county government can generate local funding from a variety of sources including: general funds, water rates, development or impact fees, sales tax connection fees, capital improvement programs, revenue bonds, acreage or ad valorem assessments, and sales taxes. Water and irrigation districts can generate local funds through benefits assessment, water standby and availability charges, sales taxes, water service fees, developer fees; or by generating revenue through water sales, groundwater banking, exchange, or transfer related

contracts. Increasing benefits assessments or fees by the overlying water district, irrigation districts or the land use agency, may require studies and a special election and/or protest hearing pursuant to state laws including Proposition 218. Local funding is often the funding source for grant cost sharing and project operation and maintenance.

Operation and Maintenance Funding

Operation and maintenance (O&M) funding for infrastructure projects is generally required from those agencies directly benefitting from the project. The Authority is not responsible for project O&M expenses and grant and loan programs typically do not cover these expenses. Before undertaking a new project, a member must estimate the O&M expenses and define a long-term funding source.

Funding Trends

A number of key trends related to state and federal funds will influence local access to funds and the Authority's financial strategy.

1. State and federal deficits. Deficits have reduced the availability of general-fund revenues to the agencies that previously provided technical support and funds for water-project development.
2. Reduced state and federal grant and loan funding. Many state and federal programs for grant and loan funding have been reduced or curtailed as more pressing social needs redirect funds.
3. Bond funding for planning and implementation. In the past, propositions 204, 13 50, and 84 have provided a source of funding for groundwater investigations, project construction, and groundwater management plans. IRWMP funding from these sources has ended. Proposition 1 funding is currently available and is available to each IRWM region on a competitive basis.
4. Increased requirements for generating special district fees and assessments. Proposition 218 did for special districts what Proposition 13 did to local government ad valorem taxes. Any new fee or assessment requires notice to property owners. Some assessments require voter approval and compliance with legislative and constitutional mandates to conduct the election, and engineering studies to prove benefits and distribute costs.
5. State move toward fee-based revenue for service. Reduced general-fund revenues have put the burden on state agencies to increase fees for service such as water-rights permits, dam safety, and other payments by the regulated community.
6. Increased competition for grant and loan funds. Reduced local government revenues increase competition for any sources of non-local funds.
7. Beneficiary pays principal. Large state and federal programs, such as CALFED, are requiring detailed economic analyses that document who receives project benefits and how payment for program implementation is to be distributed.

IRWMP Approach and Policy to Finance and Funding

The Authority has established the following guidelines regarding project funding:

1. Local funding sources must be firmly defined for all projects requiring local funds.
2. Local funding match requirements are to be provided by the project stakeholder or stakeholders (partners) that are the direct beneficiaries as defined by engineering and economic evaluations.
3. Specific agreements between project partners must clearly define the mechanism for cost sharing and on-going project O&M.
4. All new projects not already covered by an existing funding mechanism will need to expeditiously engage their communities and obtain approvals for any new project funding, whether for capital construction or O&M costs.
5. Impact fees on new development are appropriate for funding IRWMP related projects where the nexus between the development and impacts to the groundwater basin can be substantiated by a groundwater impact study.

For IRWMP common elements defined in the IRWMP, the following funding principles apply:

1. The common elements represent programs to meet common needs of the overlying water users in the Kings Basin and all stakeholders derive some benefit from implementing these programs.
2. The common elements can most cost effectively be implemented and managed by the Authority and should be compensated for services provided in coordinating programs.

Reserve Funds

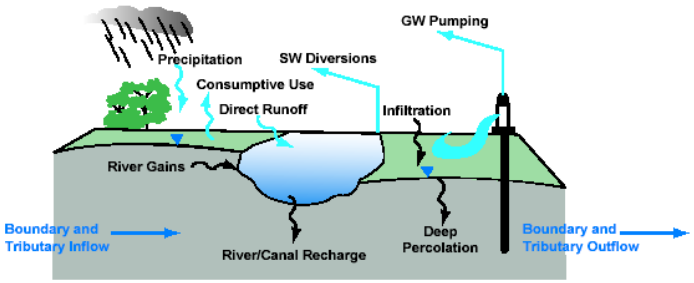
The Authority developed a Reserve Fund Policy in January 2012 (Policy No. UKB-004) that sets a target amount not to exceed $500,000 as a reserve fund. The policy identifies several possible uses for the reserve account including development of collective benefit projects, matching funds for projects, IRWMP updates, and other miscellaneous costs.

12 TECHNICAL ANALYSIS

The Kings Basin Water Authority (Authority) performed extensive analyses to support the 2007 Integrated Regional Water Management Plan (IRWMP). These analyses included studies on regional water supplies, water demands, hydrogeologic conditions, land use, and water quality. Many of these studies were used to help develop a regional hydrologic model for the Kings Basin. The information in these studies is still generally considered valid and was used in preparing this IRWMP. As a result, only a limited amount of new analysis was needed to update this IRWMP. Updated Urban Water Management Plans submitted to DWR and water quality data submitted to the State Water Resources Control Board were the primary sources of new technical information required for this update.

12.1 Water Resources Model

The Kings Basin Integrated Groundwater and Surface Water Model (IGSM or Model) is a regional model that simulates surface water and groundwater systems in the entire Kings Basin. It is the first comprehensive model of the Kings Basin that incorporates the past four decades of detailed historic conditions. The model was calibrated with data from a 41-year period and can be used to simulate future conditions. Detailed information on the Kings Basin IGSM is available in a model development and calibration document (WRIME, 2005). Section 4 of the 2007 IRWMP includes detailed justification for the parameter values used in the model, and the results of model runs to estimate future overdraft.



General Hydrologic Cycle for Kings Basin

The objectives of the model are to provide the following:

- An analytical tool that can represent the groundwater and surface water flow systems and their interactions;
- A planning level analytical tool that can provide quantitative information on a comparative basis to help answer questions on the groundwater and surface water system characteristics, and help evaluate alternative water management strategies;
- A tool that can be used in assessing management strategies consistent with the IRWMP Goals and Objectives; and
- A calibrated model that documents the historical conditions in the basin, quantifies overdraft, and creates better understanding of how the Kings Basin has been operated in the past.

The model supports the Authority's adaptive management strategy and can be used for comparison of alternatives; selection and sizing of facilities; determination of project feasibility; environmental evaluations; and evaluation of project benefits and costs.

Prior model runs evaluated three conditions: 1) baseline condition; 2) conditions in 2030 assuming no new development occurs; and 3) conditions in 2030 assuming some urban growth, which includes some agricultural areas being converted to urban lands. The modeling results concluded that, under current water management conditions, groundwater levels will continue to decline, groundwater overdraft will increase, and new depression areas will develop. Groundwater overdraft will be the greatest in the areas of Raisin City Water District, and the Cities of Fresno and Clovis.

Several studies were performed to collect data and project future conditions for modeling efforts. These reports provide important technical data that is generally still considered valid. These reports include:

- Hydrogeologic Investigation (Brown and Caldwell and WRIME, Feb. 2006)
- Modeling Objectives and Strategy (WRIME, Feb. 2006)
- Baseline Conditions (WRIME, Mar. 2006)
- Analysis of Water Demands in Kings Basin (WRIME, Apr. 2006)
- Analysis of Water Supplies in Kings Basin (WRIME, May 2006)
- 2005 Existing Conditions & 2030 Baseline Assumptions (WRIME, Oct. 2006)
- Summary of Land Use and Water Use (WRIME, Sept 2004)
- Hydrologic Modeling of the Kings Groundwater Basin (WRIME, Nov. 2005)

The Authority may develop or use other hydrologic models in the future, especially if alternative platforms are found that can increase the flexibility or utility of the model.

12.2 Revised Groundwater Overdraft Calculations

Groundwater level data was collected biannually and documented in an annual regional groundwater report through 2015; however, the Sustainable Groundwater Management Act requires that groundwater data is tracked by basin and groundwater monitoring and reporting will now be conducted through the GSAs within their respective basins. Historic groundwater changes are useful to characterize the basin, so a discussion of the past practices within the IRWM is included. Groundwater contour maps and an estimate the change in groundwater storage (See Chapter 9 – Plan Performance and Monitoring and Chapter 10 – Data Management) were previously generated by KRCD for the IRWMP annual report. **Figure 12-1** shows historic changes in groundwater storage from 1964 to 2015. The Kings Basin model was used to estimate future overdraft by assuming the future hydrology mimics past hydrology (see Section 4 in 2007 IRWMP). Future groundwater overdraft was re-evaluated using a simple trend-line analysis. This method extended the average groundwater level decline between 1964 and 2015 to the year 2035. The results from this simplified analysis are shown on **Figure 12-1**.

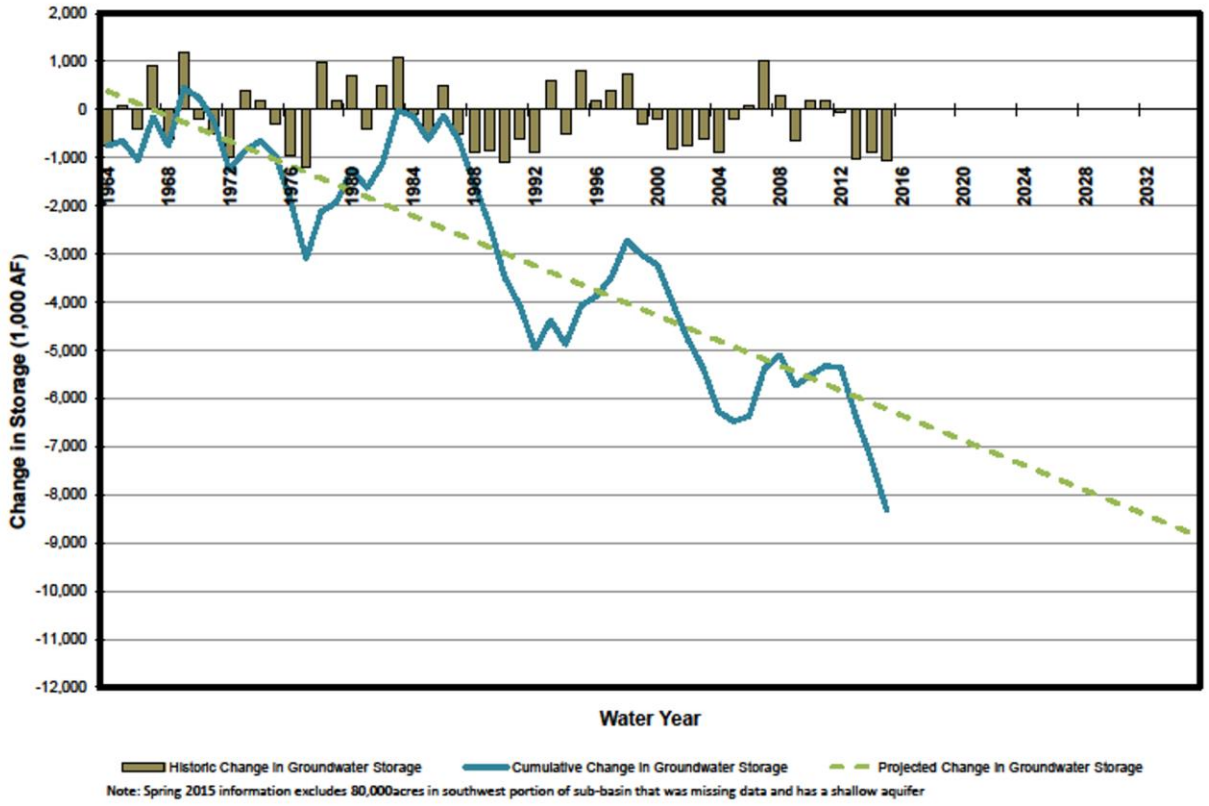


Figure 12-1: Change in Groundwater Storage in Kings Basin (1964-2035)

Figure 12-1 predicts an average groundwater storage decline of 122,000 acre-feet per year (AF/year). In comparison, detailed model runs documented in the 2007 IRWMP estimated a decline from 1964-2004 of 161,000 AF/year and a long-term decline of 105,000 AF/year. The long-term average has been estimated to be lower than the current average annual storage change as cropping patterns and demands have increased in the last 20-30 years. **Figure 12-1** illustrates the significance of the groundwater overdraft problem in the Kings Basin, and consequently the Authority has identified groundwater overdraft as their primary concern. The trendline method is a simplified analysis that does not require sophisticated model runs, but still yields reasonable results.

12.3 Climate Change

The Authority investigated the potential impacts from climate change through a climate change vulnerability assessment, and review of several climate model runs performed by others (see Chapter 17). Future analysis could include updated climate change projections to reflect new data, methods, or understanding of climate change, and evaluation of river flow data for evidence of climate change.

12.4 Disadvantaged Communities

The Kings Basin Water Authority performed a study (Kings Basin DAC Pilot Study) to evaluate water supply and water quality problems in local disadvantaged communities (DACs). The study was completed in 2013 and culminated in a final report entitled *Kings Basin Water Authority Disadvantaged Community Pilot Project Study,* dated August 2013. The results of the study highlighted groundwater quality problems throughout the Kings Basin and indicated potential solutions for several of those problems. Refer to Section 4.6 for a more extensive description of the study. The results of this study are considered incorporated into this IRWMP by reference.

13 RELATION TO LOCAL WATER PLANNING

13.1 Introduction

This chapter discusses the relationship between the Integrated Regional Water Management Plan (IRWMP) process and current local water planning efforts. The purpose of this section is to summarize the local planning elements being incorporated into the IRWMP, and the coordination of the local efforts to maintain consistency with the IRWMP and other local efforts within the Region. The specific topics discussed in this Chapter include:

- Water Plans Utilized in the IRWMP
- Relationship between IRWMP and Local Plans

Climate change elements in local water plans are addressed in Section 17.

13.2 Water Plans Utilized in the IRWMP

Water Plans can take a variety of forms and cover a wide variety of components including drinking water, wastewater, flood control and storm drainage.

Within the Region, there are communities with many different forms of water plans. The water plans discussed within this Chapter include:

- General Plan (Conservation Element)
- Groundwater Management Plan (GWMP)
- Agriculture Water Management Plan (Ag WMP)
- Urban Water Management Plans (UWMP)
- Water Master Plan (WMP)
- Sewer System Master Plan (SSMP)
- Wastewater Management Plan (WWMP)
- Stormwater/Storm Drain Master Plan (SWMP or SDMP)
- Flood Control Master Plan (FCMP)
- Water Conservation Plan (WCP)
- Stormwater Resources Plan (SWRP)

Water plans from the Member and Interested Party agencies were reviewed and sections of the IRWMP were updated based on information, issues, and potential solutions provided in the plans.

13.2.1 Urban Water Management Plans

The UWMP is a requirement of the Urban Water Management Planning Act (UWMPA) (Division 6, Part 2.6 of the California Water Code (CWC) §10610-10656). The UWMPs

must be filed every five years and submitted to the Department of Water Resources (DWR). The submittal is required to meet the requirements of the UWMPA, including the most current amendments that have been made. The UWMPA applies to urban water suppliers with 3,000 or more connections being served or supplying more than 3,000 acre-feet (AF) of water annually.

UWMPs are required of the state's urban water suppliers in an effort to assist their resource planning and to ensure adequate water supplies are available for future use. A secondary purpose of the UWMP is to provide a plan or series of plans during water drought situations.

Table 13-1: Urban Water Management Plans

Members & Interested Parties	Water Planning Documents
Bakman Water Company	Bakman Water Company 2015 UWMP Update (June 2016)
City of Clovis	Clovis 2015 UWMP Update (July 2016)
City of Dinuba	Dinuba 2015 UWMP Update (June 2016)
City of Fresno	Fresno 2015 UWMP Update (June 2016)
City of Kerman	Kerman 2015 UWMP (June 2017)
City of Kingsburg	Kingsburg 2015 UWMP Update (September 2017)
City of Reedley	Reedley 2015 UWMP Update (February 2017)
City of Sanger	Sanger 2015 UWMP Update (January 2018)
City of Selma	California Water Service Company 2015 UWMP Update, Selma District (June 2016)

The components of the UWMP include system supply and demand, supply reliability, water shortage contingency, and conservation measures. Portions of each chapter are dedicated to discussing groundwater pumping, recharge, groundwater levels, and conservation measures for reducing demand. The IRWMP has a stated goal of including all of these components, providing opportunity for collaboration and integration between the Kings Basin Water Authority (Authority) and a regional perspective and the local water suppliers.

13.2.2 Groundwater Management Plans

Many communities and water agencies have prepared a GWMP or are part of a larger regional plan, as shown below. The purpose of groundwater management plans is to work toward improving or maintaining a reliable groundwater supply within the area. Additionally, a GWMP will serve as a resource for neighboring communities within the same hydrologic region to assist in coordinated groundwater planning efforts.

The remaining members or interested parties who do not have a water planning document (UWMP or GWMP) are able to adopt the IRMWP to serve the goals of water management within their communities.

Table 13-2: Groundwater Management Plans

Members & Interested Parties	Water Planning Documents
Alta Irrigation District	AID GWMP (June 2010)
City of Clovis	Fresno Area GWMP (December 2006)
City of Dinuba	AID GWMP (June 2010)
City of Fresno	Fresno Area GWMP (December 2006)
City of Kerman	Fresno Area GWMP (December 2006)
City of Kingsburg	CID GWMP (March 2009)
City of Parlier	CID GWMP (March 2009)
City of Reedley	AID GWMP (June 2010)
City of Sanger	CID GWMP (March 2009)
City of Selma	CID GWMP (March 2009)
County of Fresno	Fresno Area GWMP (December 2006)
Consolidated Irrigation District	CID GWMP (March 2009)
Fresno Irrigation District	Fresno Area GWMP (December 2006)
Fresno Metropolitan Flood Control District	Fresno Area GWMP (December 2006)
Kings County Water District	KCWD GWMP (May 2011)
Kings River Conservation District	KRCD Lower Kings Basin GWMP (April 2005)
Bakman Water Company	Fresno Area GWMP (December 2005)
City of San Joaquin	JID GWMP (November 2010)
Crescent Canal Company	KRCD Lower Kings Basin GWMP (April 2005)
James Irrigation District	JID GWMP (November 2010)
Laguna Irrigation District	KRCD Lower Kings Basin GWMP (April 2005)
Liberty Canal Company	KRCD Lower Kings Basin GWMP (April 2005)
Liberty Water District	LWD GWMP (January 1996)
City of Orange Cove	Orange Cove Irrigation District GWMP (June 2006)
Raisin City Water District	KRCD Lower Kings Basin GWMP (April 2005)
Riverdale Irrigation District	KRCD Lower Kings Basin GWMP (April 2005)

GWMP have several components that overlap the objective of the IRWMP, including groundwater management, local agency involvement, and groundwater sustainability. Nearly all of the GWMPs are to some extent regional efforts; for example, the Fresno Area Regional GWMP includes ten participating agencies, seven of which are Members or Interested Parties of the IRWMP. Groundwater degradation and overdraft causes and

solutions are primary topics of discussion in the IRWMP. Considering the semi-regional perspective of many of the GWMPs, incorporation of the information and conclusions of the GWMPs will be relatively easy. Also, in future GWMP updates, the IRWMP can be utilized as a resource to help guide the local agencies to maintain a regional perspective.

13.2.3 Water, Wastewater and Stormwater Master Plans

Water, Wastewater and Stormwater Master Plans are typically prepared by incorporated cities and counties or flood control agencies. The plans give a framework for the future development of the area; indicating types and sizes of facilities required for various type of land use. These types of master planning efforts are largely tied to the Land Use element of the General Plans for the communities, which are discussed more extensively in Chapter 14.

Table 13-3: Water, Wastewater and Stormwater Master Plans

Members & Interested Parties	Water Planning Documents
City of Clovis	Clovis WMP Update (April 2017[1]) Clovis WWMP Update (April 2017[1]) Clovis Recycled WMP (February 2017[1]) Clovis SSMP (July 2009) FMFCD Services Plan (September 2009)
City of Dinuba	Dinuba WMP (January 2008) Dinuba SSMP (August 2012) Dinuba SDMP (June 1989)
City of Fresno	Fresno Metropolitan Water Resources Management Plan Update (January 2014) Fresno SSMP (2009) Fresno WWMP (2006) FMFCD Services Plan (September 2009)
City of Kingsburg	SKFCSD[2] SSMP (October 2006) Kingsburg SDMP (June 2005)
City of Reedley	Reedley SSWMP (July 2009)
City of Selma	SKFCSD[2] SSMP (October 2006)
County of Fresno	Fresno County SSMP (April 2010) FMFCD Services Plan (September 2009)
County of Tulare	Tulare County Flood Control MP (June 1971)
Fresno Metropolitan Flood Control District	FMFCD Services Plan (December 2017)
City of San Joaquin	WMP (July 1995) SSMP (July 1995)

Notes:
[1] Final Draft plan, not adopted
[2] Selma-Kingsburg-Fowler Sanitation District

Components of typical sewer, water and storm drain master plan documents are listed in **Table 13-4**.

Table 13-4: Master Plan Components Germane to IRWMP

Type of Master Plan	Typical Components
Sewer System Management Plan (SSMP)	Emergency Overflow Response Plan Fats, Oil and Grease Control Plan[1] System Evaluation & Capacity Assurance Monitoring, Measurement & Modifications
Wastewater Master Plan (WWMP)	Hydraulic Model & Analysis Land Use Flow Projections Capital Improvement Program
Water Master Plan (WMP)	Existing System Details Future System Details
Storm Drain / Flood Control Master Plan (SDFCMP)	Groundwater Recharge Future Drainage Ideology

The components of the SSMP and WWMP are important points of consideration for the Authority because sewer system problems can cause complex problems with water quality if a plan is not in place to address the issues as they arise. The cities with sewer master plans illustrate their prevention and reaction plans and provide important information for the IRWMP to reference.

WMPs, from the large Fresno Metropolitan Plan to the smaller city plans, all include details on the existing system and incorporate land use demands in determining the requirements for building future system components. The integration of land use components in the water planning document resonates with the IRWMP goal of more extensive coordination between land use and water planning representatives.

SDMPs provide a vehicle for discussion of recharge basin locations throughout the Kings Basin Region. A few plans cover a larger area and include multiple communities, such as the Fresno Metropolitan Flood Control Master Plan. These types of plans provide a semi-regional approach to stormwater and have already started the process of a regional approach to this topic. The IRWMP can easily incorporate some of the strategies from these larger plans and provide an avenue for them to coordinate in the future, helping to maintain a region-wide approach to stormwater issues.

13.2.4 Water Conservation Plans

WCPs are intending to provide for a plan during periods of short- and long-term drought conditions. Many cities that are required to prepare a UWMP include their water

conservation plan within the UWMP rather than preparing a separate document. The City of San Joaquin is one of the smaller communities who prepared a separate Water Conservation Strategy.

The WCPs, whether a stand-alone plan or as an inclusion in the UWMP, provide a comprehensive look at conservation measures. Typically, these plans provide for reactionary measures during periods of drought, not for overall water use reduction in a normal year.

13.2.5 Agricultural Water Management Plans

The Water Conservation Act of 2009 (SBx7-7) requires the preparation and submittal of an Agricultural Water Management Plan (Ag WMP) from certain agricultural water suppliers by the end of 2012. Each Plan is then required to be updated every 5 years.

The purpose of Ag WMPs is to provide past and current statistics on population, irrigated acres, crop demands, soil conditions, water demands and conservations practices within the Districts.

Table 13-5: Agricultural Water Management Plans

Members & Interested Parties	Water Planning Documents
Alta Irrigation District	AID Ag WMP (November 2015)
Consolidated Irrigation District	CID Ag WMP (July 2016)
Fresno Irrigation District	FID Ag WMP (February 2016)
James Irrigation District	JID Ag WMP (August 2016)

Ag WMPs contain a section on the water supply of the District (both surface and groundwater), which specifically discusses the conjunctive uses within the District. Conjunctive use is listed as a Statewide Priority in the IRWM Guidelines and is discussed in Chapter 8 of this IRWMP. Conjunctive use is also a method to integrate water and land use management strategies, which is another item of importance to the Authority. Ag WMPs also have a strong focus on agricultural water use efficiency, an important resource management strategy in the Kings Basin.

13.2.6 General Plans

California Government Code (§65350-65362) requires that each county and city in the state develop and adopt a General Plan. The General Plan consists of a statement of development policies and includes a diagram or diagrams and text setting forth objectives, principles standards, and plan proposals. It is a comprehensive long-term plan for the physical development of the county or city. In this sense, it is a "blueprint" for development.

The General Plan must contain seven (7) state-mandated elements. It may also contain any other elements that the legislative body of the county or city wishes to adopt. The seven (7) mandated elements are: Land Use, Open Space, Conservation, Housing, Circulation, Noise, and Safety. The General Plan may be adopted in any form deemed appropriate or convenient by the legislative body of the county or city, including the combining of elements.

Table 13-6: General Plans

Members & Interested Parties	Water Planning Documents
City of Clovis	Clovis 2035 General Plan (August 2014)
City of Dinuba	General Plan Policies Statement (September 2008)
City of Fresno	Fresno 2035 General Plan (December 2014)
City of Kerman	Kerman 2027 General Plan (2007)
City of Kingsburg	Kingsburg Comprehensive General Plan (July 1992)
City of Orange Cove	Orange Cove General Plan (1995)
City of Parlier	Parlier 2030 General Plan (February 2010)
City of Reedley	Reedley 2030 General Plan (February 2014)
City of Sanger	Sanger 2025 General Plan (November 2003)
City of Selma	Selma 2035 General Plan (October 2010)
County of Fresno	Fresno County General Plan (August 2010)
County of Tulare	Tulare County 2030 General Plan (February 2010)
City of San Joaquin	San Joaquin 2035 General Plan (July 2014)
County of Kings	2035 Kings County General Plan (January 2010)

General Plans contain a section on water resources within the Conservation Element, which confers the agencies goals with respect to water management within their jurisdiction. This discussion provides a simplistic way for the Goals and Objectives of the IRWMP to be compared to the local agencies'; also allowing for coordination of those goals between documents to provide a unified theme for the region. Many of the general plans within the Kings Basin specifically discuss cooperation with the IRWMP or local agencies in relationship to groundwater recharge, water balancing, water quality issues, etc.

13.2.7 Stormwater Resources Plan

Water Code (§10562(b)(7)) requires public agencies to develop a Stormwater Resources Plan (SWRP), or functional equivalent (FE-SWRP) to be eligible to receive grant funds from any bond measure approved after January 2014 for implementation of stormwater

projects. The SWRCB established guidelines for developing an SWRP or FE-SWRP and adopted those guidelines in December 2015.

The FMFCD prepared and self-certified an FE-SWRP covering their entire District boundary in July 2017 and submitted it to the SWRCB for verification. The remainder of the IRWM region is accounted for within the KBWA SWRP. Through adoption of this IRWMP Update, the adopting agencies are adopting the KBWA SWRP by incorporation.

13.3 Relationship between IRWMP and Local Plans

The Region is home to many incorporated cities, unincorporated communities, and counties, which are shown on several figures in Chapter 3. The water planning representatives from the communities and counties are encouraged to actively participate in the Authority and many take advantage of the IRWM process to be involved in regional efforts. These representatives provide important data and information and provided critical guidance during the planning process.

The local planning documents are often a reflection of the same goals, objectives, and strategies as the IRWMP. The Authority is comprised of many local leaders, council members and department directors, who serve as a link between the IRWMP and local water planning efforts. Further, the local agency members and interested parties individually adopt this IRWMP as a separate action by their Board or Council.

As the implications of the SGMA and climate change become more apparent and strategies are developed to comply with those requirements or impacts, the IRWMP will consider implementing or incorporating those strategies through the Annual Report process or within future updates.

13.3.1 Jurisdictions of Local Plans

The local planning documents are confined to the area under the city, community or local entity's purview. For the cities and communities, the jurisdiction is limited by the city limits or sphere of influence depending on the document. The county's jurisdiction is limited by the county limit lines and typically applies only to the unincorporated areas of the county. Special districts such as water, conservation, irrigation or flood control, community services and public utility districts will have an adopted district boundary which serves as the jurisdiction limit. Special districts may also have Local Agency Formation Commission (LAFCO) approved spheres of influence.

13.3.2 Local Plan Updates

The majority of local planning documents are either mandated for periodic update or the local agency elects to update them for accuracy. To the extent feasible, the IRWMP will consider the most current documents during IRWMP Update processes but will not amend or update the IRWMP based solely on a local planning document update.

Members and interested parties should refer to the IRWMP in their local plans where applicable.

13.3.3 Regional Efforts Lead to Local Efforts

The regional planning efforts are intended to serve as a basemap or guideline for the entire region to follow in regards to water resources. The foundation of the IRWMP will continue to be the successful implementation of local projects and programs that help accomplish the region's Goals and Objectives. Local agencies without planning documents in place may elect to use the IRWMP in lieu of or as a beginning point for their own local planning documents.

13.3.4 Planning Document Inconsistencies

Inconsistencies may occur occasionally between the regional and local planning documents. Some of these occurrences may be solved through discussion and collaboration between the local agency and the Authority. If it is determined the inconsistency is of vital significance to the IRWMP and out of sequence with a planned update, the Authority will incorporate updated information into the Annual Report or, if necessary, prepare a special update.

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14 RELATION TO LOCAL LAND USE PLANNING

14.1 Introduction

This chapter discusses the relationship between the Integrated Regional Water Management Plan (IRWMP) process and current Local Land Use Planning efforts. The purpose of this section is to summarize the local planning elements being incorporated into the IRWMP and the coordination of the local efforts to maintain consistency with the IRWMP and other local efforts within the Region. The specific topics discussed in this Chapter include:

- Link Between IRWM and Land Use Planning
- IRWMP Relationship with Land Use Planning Agencies
- Future Efforts to Establish Relationships with Land Use Planning Agencies

14.2 Link between IRWM and Land Use Planning

The IRWM process provides for many opportunities to collaborate and integrate with local land planners both at the city and county levels. Integration of the prevailing land use with water supply plans and the water planning process is an important strategy for the Kings Basin IRWMP. The Authority includes several local council members and agency directors, who oversee many divisions of their respective jurisdictions, including land use planning. Inclusion of land use planning personnel in the IRWMP process allows for the regional Goals and Objectives to be more completely implemented through policy change and project development.

The link between IRWM and land use planning has a considerable number of common considerations, both providing an opportunity to garner important input on a multitude of issues. The issues which could be affected include: flood management, groundwater recharge, conjunctive water use, treatment facilities, water conservation, adaptation to and potentially offsetting impacts from climate change, municipal and recreational development, general plan policies, planning and development review, and land use modification to improve water resource management.

Water agencies can encourage local land use agencies to protect groundwater recharge areas; restrict and provide alternatives to development in floodplains; evaluate adequacy of water quality and septic system disposal for new developments; and encourage development of local water, wastewater and storm drain projects to integrate and maximize the potential for meeting regional goals and measurable objectives.

14.3 IRMWP Relationship to Land Use Planning Agencies

The IRWMP Region overlaps parts of Fresno, Tulare, and Kings Counties. The incorporated cities, unincorporated communities, and county boundaries in the Kings Region are shown in Chapter 3. City and County representatives from the planning or public works agencies actively participated in the IRWM process. These representatives provide a conduit to the elected bodies through the planning process. They also support collection of important data and information and provide critical guidance for planning purposes. **Figure 14-1** shows how local planning efforts in the Kings Region are integrated and how the IRWMP fits into larger scale efforts.

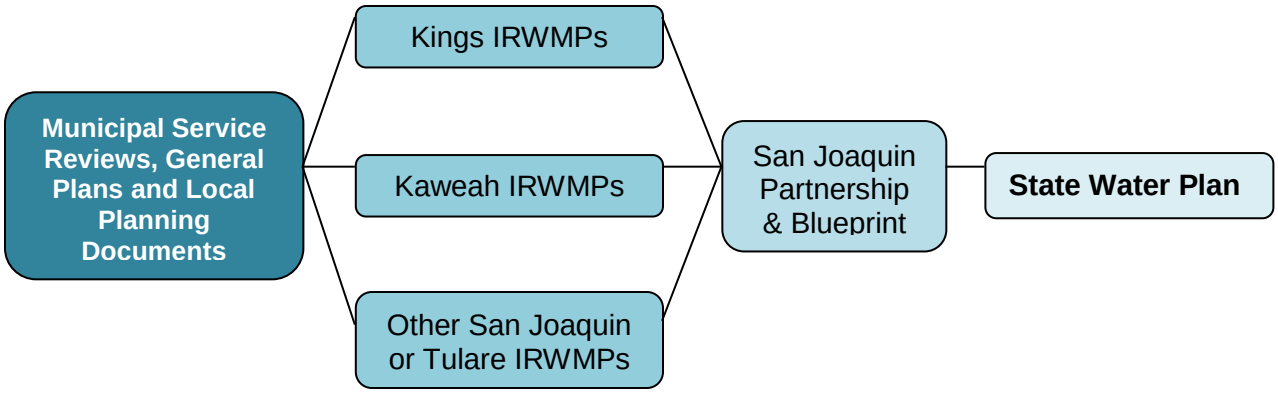

Figure 14-1: IRWMP Relationship to Local Planning

Under California law, the management of land use is the responsibility of local government. Land use planning requirements for each jurisdiction are defined by City and County general plans and the associated goals, policies, objectives and programs. They guide land use decisions at the city and county level, typically resulting in less detailed or comprehensive review of regional water issues. They are comprehensive and integrated across the full spectrum of land, water, and natural resources management elements.

In the past, land use and water supply decisions were made independently; however, in recent years legislation and court precedence have begun changing the planning process. Two such pieces of legislation, SB610 and SB 221, are companion measures with the intent to promote collaborative planning between cities, counties and water suppliers. SB610 requires the preparation of Urban Water Management Plans and water supply assessments for larger development projects or land use plans. SB221 prohibits a land use agency from approving a subdivision map of more than 500 units without a letter of verification that sufficient and reliable water is available.

Similarly, Local Agency Formation Commissions (LAFCOs) are required to ensure water supplies are available before approving city or district boundary amendments.

Additionally, they are responsible for approving a Municipal Service Review (MSR) prior to updating a sphere of influence, which must be updated every five years.

Updates to the General Plan Guidelines recommend that local agencies include a Water Element in their general plans with the intent that the general plans would incorporate the city or county's Urban Water Management Plan (UWMP) (if applicable) and codify requirements to comply with SB610/221.

For the development of the IRWMP, the city and county information was important for characterizing the historical and existing conditions in the Kings Region (WRIME, 2006); documenting demand and supply conditions (WRIME, 2006); formulating the assumptions for the future without project land use and water supply conditions (WRIME, 2006); and developing and evaluating the project elements. The IRWMP process included consideration of the existing land use plans to help ensure consistency with the IRWMP, and thus minimize the potential for conflicts between the plans

The city and county agencies and Fresno, Kings and Tulare County Local Agency Formation Commissions were consulted to obtain critical planning information, including general plans and MSRs, which are listed in **Table 14-1.**

Table 14-1: Land Use Planning Documents

Members & Interested Parties	Land Use Planning Documents
City of Clovis	Clovis 2035 General Plan (August 2014)
City of Dinuba	General Plan Policies Statement (September 2008) MSR (June 2012)
City of Fresno	Fresno 2035 General Plan (December 2014)
City of Kerman	Kerman 2027 General Plan (2007)
City of Kingsburg	Kingsburg Comprehensive General Plan (July 1992)
City of Orange Cove	Orange Cove General Plan (1995)
City of Parlier	Parlier 2030 General Plan (February 2010)
City of Reedley	Reedley 2030 General Plan (February 2014)
City of Sanger	Sanger 2025 General Plan (November 2003)
City of Selma	Selma 2035 General Plan (October 2010)
County of Fresno	Fresno County General Plan (August 2010)
County of Tulare	Tulare County 2030 General Plan (February 2010)
Consolidated Irrigation District	MSR (October 2007)
Fresno Irrigation District	MSR (July 2007)
Fresno Metropolitan Flood Control District	MSR (June 2014)

Members & Interested Parties	Land Use Planning Documents
Raisin City WD	MSR (August 2007)
Biola CSD	MSR (August 2013)
City of San Joaquin	San Joaquin 2035 General Plan (July 2014)
County of Kings	2035 Kings County General Plan (January 2010)
Cutler PUD	MSR (March 2006)
East Orosi CSD	MSR (October 2011)
Easton CSD	MSR (September 2011)
Lanare CSD	MSR (December 2007)
Laton CSD	MSR (September 2011)
Liberty WD	MSR (August 2007)
London CSD	MSR (May 2006)
Malaga CWD	MSR (October 2007)
Mid-Valley WD	MSR (August 2007)
Orosi PUD	MSR (May 2006)
Pinedale CWD	MSR (June 2016)
Riverdale ID	MSR (July 2007)
Riverdale PUD	MSR (February 2018)
Sultana CSD	MSR (October 2011)

DWR is recommending that land use planning be one of the water management strategies that should be included in an IRWMP. A review of the existing city and county general plans was conducted, and a briefing was prepared (WRIME, 2007a) to support discussion by the Land Use and Water Supply Work Group and the preceding Water Forum. The purpose of this memorandum was to document the review of City and County General Plan goals, objectives, policies, and programs. The review specifically evaluated how each general plan recognizes regional water resources issues; incorporates water management strategies; and how achievement of these goals could be supported by the IRWMP being developed by the Water Forum. The technical memorandum identifies the policy "drivers" that provide a basis for integrating land use, water supply plans, and the planning process. Since the WRIME memorandum was prepared, the Dinuba and the counties of Tulare and Kings have updated their general plans; the City of Fresno has also prepared an amendment to their General Plan (2009) and is in the process of preparing an update to the 2025 General Plan to extend the planning horizon. A review of the updated general plans and all MSRs was conducted for the IRWMP and the observations are included in the list below.

The findings and observations of the reviews included the following:

- County general plans are characteristically more regional in their viewpoint
- City general plans do not typically focus on regional overdraft issues and solutions
- City general plans do not generally identify impacts to irrigation district facilities as a result of development in terms of infrastructure and flood water releases
- Water supply reliability and safety is usually discussed in the general plans but in generalities; the plans should be more specific in directives toward how water supply shall be provided and verified
- Most general plans do not specifically discuss new water supply development and suggestions for groundwater management
- Many general plans do discuss integrated land use and water supply planning
- The more recent general plan updates focus on more regional efforts overall due in part to new requirements for general plans; however they still discuss water issues in generalities, not specifics
- MSRs typically discuss general information regarding recharge and growth, without listing specific plans toward reaching these goals

14.4 Efforts to Establish Relationships with Land Use Planning Agencies

As previously discussed, cooperation between land planning representatives and the IRWM is critical to the successful implementation of regional water management efforts. Establishing new and strengthening existing relationships will contribute to the Kings Basin's success. There are several key approaches for continuing ongoing and facilitating the future relationships with local agencies:

- Internal discussion within the Authority regarding land planning issues
- Review and comment on new land planning policies of the agencies within the Region
- Encourage land-use planners to attend regular Advisory Committee meetings
- Give presentations on water planning and IRWMPs at local chapters for land-use planning professional societies
- Exploration of projects that will facilitate the modification of land planning policy to encourage implementation of region-wide beneficial water management
- Conduct bi-annual meetings between the Authority and local land planning representatives for the purposes of discussing upcoming policy changes or implementation of the IRWMP
- Promote inter-agency communication between the land planning and water management staff
- Maintain a current list of land planning staff at all local agencies including counties, cities and unincorporated communities

The IRWM is committed to maintaining open channels of communication and facilitating continued involvement of the land planning community in the IRWMP process and implementation.

15 STAKEHOLDER INVOLVEMENT

Stakeholder involvement includes efforts to recruit and engage a diverse group of stakeholders to participate in all aspects of the Kings Basin Water Authority (Authority). Stakeholder involvement, also called public outreach, is fundamental to the success of the Authority. This chapter discusses the public outreach strategy, outreach performed to update the IRWMP, and future plans for public outreach.

15.1 Stakeholders

The Authority includes a diverse group of members and interested parties, which is the result of on-going public outreach efforts since 2004. The California Water Code (CWC) §10541(g) identifies 13 different stakeholder categories. The Authority includes 11 of the 13 different stakeholder categories. **Table 3-2** lists the members and interested parties, and their corresponding stakeholder categories. The Kings Basin Water Authority also satisfies the definition of a Regional Water Management Group provided in the CWC (see Section 2.1).

Critical water supply and water quality issues of Disadvantaged Communities (DACs) are important Kings Basin concerns. Most of the communities in the Kings Basin meet the state definition of DAC, which is having a median household income less than 80 percent of the statewide average. While most small DACs cannot afford the costs to become Members of the Authority, many do participate free of cost as Interested Parties. Special efforts have been made to educate and engage DACs within the planning area. These efforts are described in Chapter 4 – Disadvantaged Communities. Chapter 4 also describes the social/cultural makeup of the region, the process for identifying DACs, and the goals and preliminary results of two large studies aimed at identifying water related problems and possible solutions in local DACs.

The Authority performed extensive outreach while preparing the 2007 Integrated Regional Water Management Plan (IRWMP). On-going outreach efforts since then have attracted more stakeholders to participate. As a result, most of the stakeholders in the region are actively participating in the IRWMP as Members or Interested Parties. However, a few are not involved either because they did not respond to previous outreach efforts, or in some cases were not directly contacted. The IRWMP Update Work Group openly discussed which stakeholders were not involved in the IRWMP and should be directly contacted. The following list was generated:

- California State University at Fresno
- Reedley College
- Local Chambers of Commerce
- University of California Cooperative Extension (agriculture)
- Local Farm Bureaus

- Agricultural commodity groups
- Malaga County Water District
- Community of Easton

Outreach is being conducted to these stakeholders by the Outreach Work Group. As a result of these efforts, the Fresno County Farm Bureau and University of California Cooperative Extension both joined as Interested Parties in April 2012. Easton Community Services District and California State University, Fresno joined as Interested Parties, in June and September 2012, respectively. In October 2012, the Board approved altering Raisin City Water District's status from Member to Interested Party.

15.2 Public Outreach Methods

In 2005, with the support of the Outreach Work Group, the Authority prepared a Community Affairs Plan to outline the stakeholder coordination process. The Community Affairs Plan is a living document and remains the backbone of the public outreach effort. The plan identifies the following goals for the public outreach process:

1. Brand the Authority as a regional entity addressing water reliability and quality, and agricultural, urban and natural resource needs.
2. Educate the public about the region's water resources issues.
3. Promote an IRWMP to gain support for water management strategies being considered by the Authority.
4. Mobilize the electorate to vote on projects that improve regional water reliability and quality.

The Authority, through the efforts of the Outreach Work Group and approval of the Board, developed a logo for the Authority to assist with the branding of the Authority as a regional entity. The logo has been incorporated into all materials, website, and e-mails that are distributed by the Authority.

The Authority maintains a website (www.kingsbasinauthority.org) that posts a variety of information on regional water management efforts including: Board of Director meeting schedules, agendas and minutes, Advisory Committee meeting schedules, agendas and minutes, list of members and interested parties, recent news, and documents (governing documents, reports, technical papers, applications and proposals). The website includes all of the major documents developed by the Authority. This website is updated regularly and also serves as an archive for important documents developed by the Authority.

The website includes a YouTube video intended to educate the general public and land use planning community by describing the Kings Basin Water Authority, IRWM efforts and critical water supply and water quality issues facing the region. (https://www.youtube.com/watch?v=0DeUK3eV8ok)

The Authority now maintains a social media presence for communication, including Facebook and Twitter accounts. The Authority is frequently the subject of local newspaper articles, some of which have included:

- *Recharge Basin in Fresno County Made to Renew Groundwater Supplies*, Fresno Bee, May 20, 2016
- *Eastern Merced Regional Water Authority in the Works*, Merced Sun-Star, February 22, 2012
- *Regional Water Planning Faces Uncertain Future*, AgAlert, January 25, 2012
- *Coalition of Water Organizations Has Proven Effective*, Sanger Herald, January 19, 2012
- *Groundwater Supply Dripping with Importance*, Kingsburg Recorder, January 18, 2012
- *Groundwater Supply Dripping with Importance*, Selma Enterprise, January 2012
- [Kings Basin] *Water Authority Leverages Funds for Regional Projects*, Dinuba Sentinel, January 5, 2012
- *Work of Local Water Association Praised*, Hanford Sentinel, December 12, 2011
- *Message from the General Manager (regarding KBWA)*, Floodline, Winter 2011-2012

These articles are often based on press releases and editorial meetings initiated by the Authority**.** The Authority is also highlighted through a video and case study by the Pacific Institute as a successful regional water management effort.

Stakeholders have opportunities to participate in the Authority through the Advisory Committee, Work Groups, and the Board of Directors. These groups are explained in Section 2 – Governance. Information is made available to stakeholders through the following methods: newsletters, newspaper articles, Authority website, Advisory Committee Meetings, Board of Directors meetings, e-mails, and various other public outreach efforts. **Figure 15-1** shows how stakeholders are contacted and how they can communicate with other members and interested parties.

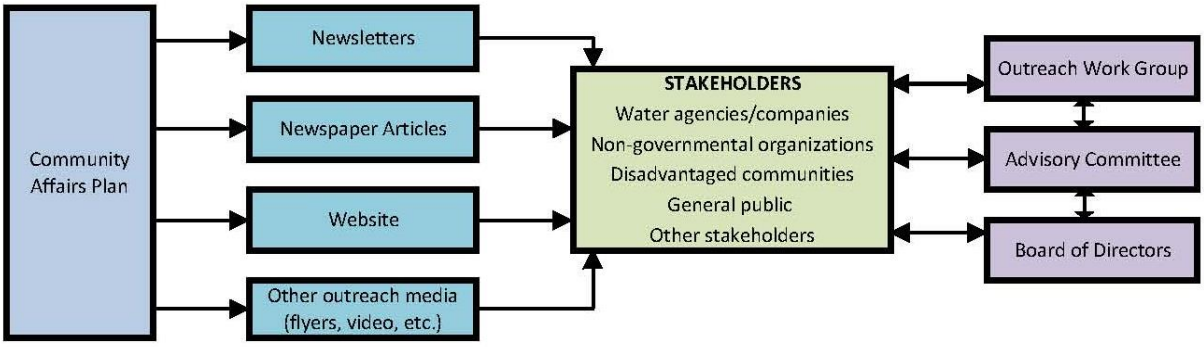

Figure 15-1: Public Outreach and Stakeholder Involvement

15.3 Public Outreach for IRWMP Development

15.3.1 Public Outreach for 2007 IRWMP

The Authority used a comprehensive public outreach program to recruit new members and solicit comments on the 2007 IRWMP. This included a combined approach of community relations and mixed media to reach the target audiences. Public outreach efforts included stakeholder and committee meetings, website pages, printed materials, newspaper articles, newsletter articles, and a speaker's bureau program that conducted presentations to 25 organizations. These efforts are documented in the 2007 IRWMP (Section 2.2.6) and were successful in engaging the majority of stakeholders in the region to join as members or interested parties.

15.3.2 Public Outreach for 2018 IRWMP Update

The public outreach process for updating the 2018 IRWMP included the following steps also utilized for the 2012 Update:

- The intent to prepare an updated IRWMP was announced at the Authority Advisory Committee and Board meetings. The item was noted on agenda that was publicly noticed and put on the Authority's website.
- In compliance with the California Water Code, the Authority published a notice that the IRWMP was being updated and considered for adoption. The notices were published in the widely circulated Fresno Bee, which is the major newspaper in the area. Copies of the notices are included in **Appendix E**.
    - The first notice, published on June 20 and 27, 2018, informed the public that the Authority was updating the IRWMP to address new State standards.
    - The second notice, published on August 28 and September 4, informed the public that the Authority was intending to adopt the updated IRWMP and solicited public review and comment on the document.
- Approximately 30 stakeholders participated in an IRWMP Update Work Group.
- Through a series of seven interactive meetings over a fifteen-month period, the Work Group reviewed each IRWMP standard and the content in the existing IRWMP. During these sessions, the Work Group members shared ideas and concerns, and came to consensus on the information to include in the updated IRWMP.
- IRWMP update progress reports were given at each Authority Advisory Committee and Board meeting, including announcement of the next IRWMP update Work Group meeting and an invitation for anyone interested to attend and participate.
- The draft revised IRWMP was prepared and submitted to each Work Group member for comments. The Work Group had approximately one month to review the draft IRWMP.

- Approximately 23 comments were received from the Work Group. A list of comments was developed and discussed at a Work Group meeting and incorporated in the IRWMP.
- The public was notified that the revised IRWMP was available for review through a local newspaper notice, Authority website, and during several Advisory Committee and Board of Directors meetings. Stakeholders were provided approximately one month to review the IRWMP and provide comments.
- Comments were collected from Advisory Committee members, Board of Directors, and the general public. A list of comments was developed and reviewed at the Advisory Committee meeting and a finalized IRWMP was produced.
- The Final IRWMP was sent to the Board for review in advance of a regularly scheduled Board of Directors meeting. A presentation was made at the meeting on the content of the IRWMP, and questions from Board members as well as others in attendance were addressed by the Authority's consultant and members of the IRWMP Update Work Group.

15.4 Decision Making

The Authority's decision-making process is transparent, and all stakeholders are afforded the opportunity to provide input on decisions. Decisions are generally made by the Board of Directors who comprises the formal Members of the Authority. All stakeholders have opportunities to provide input and comments on decisions at Board meetings or through participation in work groups, special committees, and the Advisory Committee. Decisions to fund projects or include them in grant applications are made by a special Projects Work Group. Chapter 2 – Governance includes a description of the different committees and work groups, and the decision-making protocols for the Authority.

15.5 Future Public Outreach

Future public outreach will follow the model developed during past outreach efforts. Public outreach will follow the Community Affairs Plan, which will be assessed yearly and updated, with a focus on Advisory Committee meetings, the website, newsletters, and directly contacting potential stakeholders. The IRMWP Update Work Group also concluded that the significance of the groundwater overdraft was not widely understood, and one focus of future outreach will be educating the public on the gravity of the situation, and progress made to reduce overdraft.

Most organizational stakeholders in the region are already members or interested parties, but some have not participated. The Authority recognizes that the opportunity for a stakeholder to become involved is not limited to the beginning stages of plan development. A stakeholder may become involved later as their awareness of IRWM increases or new issues or concerns develop. The Authority will continually invite new stakeholders to participate to further increase the depth and diversity of membership.

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16 COORDINATION AND INTEGRATION

Coordination and integration are two closely related Integrated Regional Water Management Plan (IRWMP) standards intended to help ensure IRWMP members are working together. The Kings Basin Water Authority (Authority) was formed as a Joint Power Authority (JPA) with the intent of establishing a foundation of coordination and integration within the region. The Authority's organization and regular meetings and efforts demonstrate those efforts. This IRWMP describes a variety of processes for stakeholders to coordinate and integrate water management efforts. This section describes these processes and references other sections of the IRWMP where they are discussed in greater detail.

Coordination involves public outreach and facilitation efforts to bring stakeholders together and work as a unified group. Coordination efforts can include specific tasks or implementation of on-going policies and procedures. The goals of coordination include the following:

- Reduce conflicts among local agencies and stakeholders
- Identify opportunities for regional or multi-agency projects
- Increase awareness of adjacent IRWMPs and their efforts
- Improve awareness of state, federal, and local agency resources, plans and projects

Integration is defined as combining separate pieces into an efficient unified effort. The broad goal of regional water management is to integrate the stakeholders into a single entity for addressing regional issues.

Coordination and integration include five main components, as shown in **Figure 16-1**.

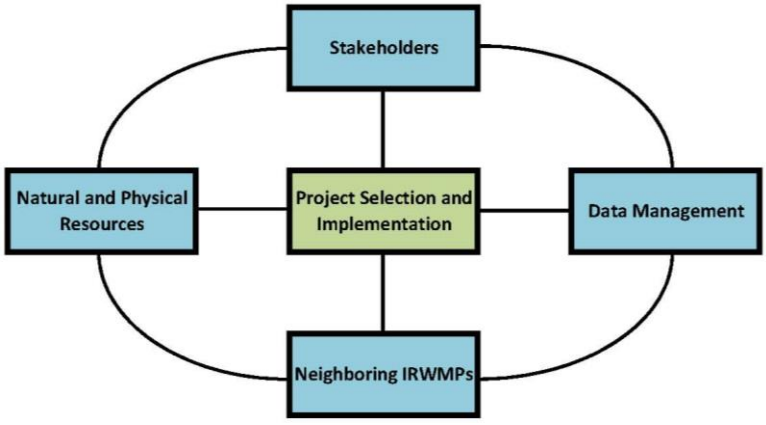

Figure 16-1: Coordination and Integration Components

Coordination and integration efforts generally overlap, and therefore they are jointly discussed below. Coordination and integration are covered in several IRWMP chapters, so the discussions below are introductory and refer to other IRWMP sections for more details.

Stakeholders

The Authority has established a governance structure that fosters both integration and coordination of stakeholders through the following:

- The members are organized under a JPA, which provides a formal and structured organization to manage regional water resources (Section 2.3). The Authority is a separate entity from each member, but all members are integrated through seats on the Board of Directors. Each member pays annual dues, helping to ensure that the Authority has long-term funding to operate.
- The governance structure allows any stakeholder to participate as an interested party (Section 2.4). Interested parties do not need to pay annual dues, allowing stakeholders with limited funding to participate. Interested parties can attend regular Advisory Committee meetings or serve on Work Groups (Section 2.4). Advisory Committee meetings provide all stakeholders a forum to exchange ideas and provide input to the Board of Directors. Numerous Work Groups provide opportunities for stakeholders to provide input on specialized topics. The Advisory Committee and Board meetings are quarterly and are scheduled for the year.
- The Authority uses a variety of public outreach methods to inform stakeholders of the Authority's efforts and accomplishments and solicit comments on projects and studies (Section 15).

Natural and Physical Resources

The Kings Basin includes valuable natural resources and water infrastructure. These resources benefit local agencies but can also be used for regional projects. Several agencies working together have significantly more resources than one working alone. Therefore, the integration of resources has the ability to enhance the outcome of any project. Resource integration can include sharing data, technical expertise or infrastructure. Resources integration is addressed as follows:

- The IRWMP provides various details on the members, interested parties, and other local, State and Federal agencies in the Kings Basin (Chapter 3 and **Appendix A**). This data informs stakeholders on the roles and responsibilities of other stakeholders, and their physical and natural resources. This ensures that stakeholders have the necessary background data to participate in regional planning and decision making.
- The Authority performed a climate change vulnerability assessment (Section 17.4). This is an integrated assessment for the Kings Basin and helps to show potential climate change impacts to the region as a whole.

Project Selection and Implementation

The Authority coordinates and integrates projects through the following policies and procedures:

- The Authority is performing a regional study on water resources problems in disadvantaged communities (Section 4.6). The study is helping to integrate and improve coordination among the Disadvantaged Communities (DACs) and the Authority.
- The Authority uses an integrated process to solicit and review projects for funding (Chapter 7). The process requires input from a Projects Work Group and the Board of Directors.
- The Authority has listed the general benefits of regional water management (Section 8.1). The goal of this list is to inform stakeholders of the value of coordinating and cooperating on regional efforts.
- The Authority has identified the benefits and impacts of implementing different types of projects (Section 8.2). This information is provided for stakeholders within the Kings Basin and for neighboring IRWMPs. The purpose of this list is to help improve coordination among parties impacted by new projects.
- The Authority solicits and publishes a list of projects, so each stakeholder is aware of proposed projects. This list can also help prevent duplication in new projects. The list will be updated annually and incorporated into the Annual Report.
- Several integrated (multi-agency) projects have been proposed by the stakeholders. The Authority will work to further develop and promote these types of projects.

Data Management

The Authority has successfully developed several programs to coordinate and integrate data management among the different parties in the Kings Basin. These programs include the following:

- The Kings Basin implements several regional monitoring programs (e.g. groundwater level, water quality, etc.) that require coordination among numerous stakeholders (Section 9.1).
- The Authority plans to prepare an annual report that will integrate data from all the members and interested parties, evaluate progress in meeting regional Goals and Objectives, document progress in implementing projects, and document proposed amendments to the IRWMP (Section 9.5).
- The Authority has developed the Kings Basin Integrated Groundwater and Surface Water Model (IGSM), which simulates hydrologic conditions in the entire Kings Basin (Section 12.1). The model was calibrated with regional hydrologic data from a 41-year period. The model can be used for regional analysis or project specific analysis.
- The Authority performs annual groundwater overdraft calculations using data collected throughout the Kings Basin (Section 12.2). The calculations provide

common ground for the members and interested parties to evaluate overdraft problems and identify needed solutions.

Neighboring IRWMPs

The Authority abuts four different IRWMP Groups (see **Figure 3-3)**. The IRWMPs do not overlap, as the various IRWMP groups have made efforts to coordinate their boundaries as much as possible. The Authority does not currently have any major conflicts with other IRWMP groups. The neighboring IRWMPs have many similarities to the Kings Basin including large agricultural demands, reliance on surface water and groundwater, and groundwater overdraft concerns. Nevertheless, this IRWMP covers a distinct hydrologic region, so the Authority sees no merit in merging with any neighboring IRWMPs. The Authority is actively involved with neighboring IRWMPs and provides information on their efforts at Advisory Committee meetings and in several sections of this IRWMP, as described below:

- The Authority coordinates with neighboring IRWMPs through letters of agreement, the IRWMP Round Table of Regions, the Tulare Basin Integrated Regional Planning Effort, and regular communication with some neighboring IRWMPs (Section 2.7)
- This IRWMP describes how projects in the Kings Basin could positively or negatively impact the four neighboring IRWMPs (Section 8.3). This information should be considered when developing new projects and coordinating them with neighboring IRWMPs.

17 CLIMATE CHANGE

17.1 Introduction

Climate change is a long-term alteration in global weather patterns such as precipitation, temperature, wind and severe weather events. Climate change can occur from both natural and anthropogenic effects. Scientists believe that a primary driver of climate change is greenhouse gas concentrations, including methane and carbon dioxide. Anthropogenic release of these gases is expected to accelerate the rate of natural climate change. Paleoclimatic evidence, such as ice cores, lake varves, and tree rings show a direct correlation between greenhouse gas concentrations and global temperatures (Ruddiman, 2002). There is broad scientific agreement that climate change is occurring and that emissions of heat-trapping gases are the primary cause.

Climate change impacts in the Kings Basin cannot be precisely predicted, but if they occur, they could include different precipitation patterns and river flows, higher temperatures, and earlier snowmelt. The California Department of Water Resources (DWR) recognizes that current climate change projections are not precise, but they require that climate change planning be incorporated into Integrated Regional Water Management Plans (IRWMPs). Further, due to the uncertainty in predictions, water managers should prepare for a range of future conditions.

The general strategy to plan for climate change in the Kings Region includes: 1) identify vulnerabilities 2) implement adaptation measures; and 3) monitor for climate change. This planning process is shown in **Figure 17-1**.

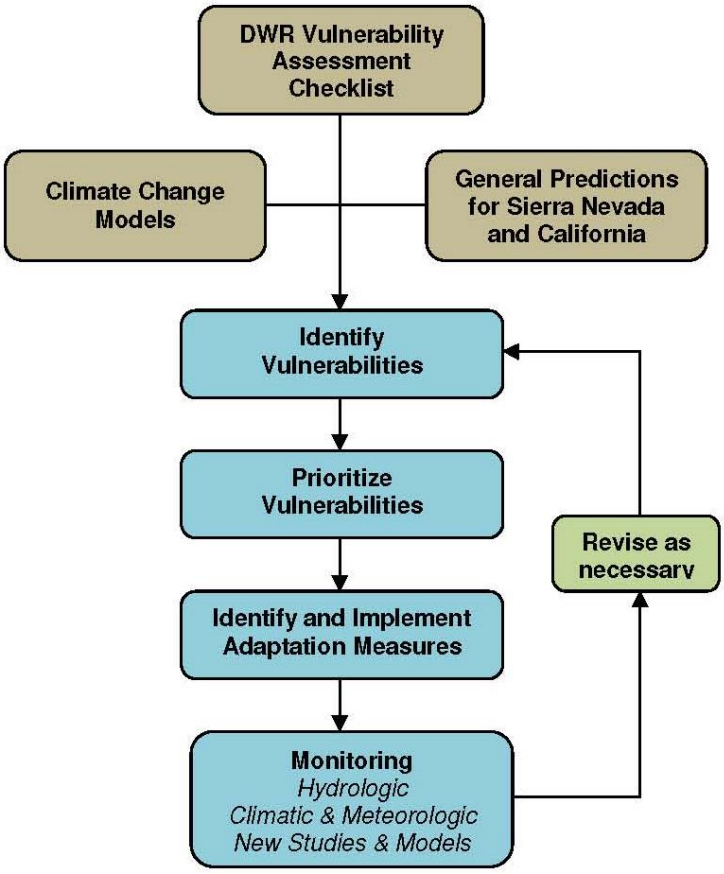

Figure 17-1: Process for Climate Change Planning

Specific topics addressed in this section include: climate change literature, general impacts from climate change, a vulnerability assessment for the Kings Basin, climate change modeling results, adaptation measures, climate change monitoring, and consideration of greenhouse gas emissions in the project review process.

17.2 Literature Review

Numerous documents were used to evaluate climate change in the Kings Basin. The primary document was the *Climate Change Handbook for Regional Water Planning*, (DWR and EPA, 2011). This handbook is the most recent, practical climate change document published by the DWR, and provides numerous tools for addressing climate change. This document is not required for preparing IRWMPs; however, DWR does recommend that it be used.

Other important climate change documents that were used include California Natural Resources Agency (2009), California State University at Fresno (2008), Conrad (2012), Climatewise (2010), DWR (October 2008), and U.S. Global Change Research Program

(2009). Lastly, several reports that describe climate change modeling results were reviewed. These are discussed in Section 17.5.

Several local water and land use plans address climate change. The climate change goals and policies in these plans are consistent with this IRWMP. For example, the General Plans for the City of Selma, Tulare County and Kings County outline numerous climate change mitigation measures such as energy efficiency requirements at new developments, compact urban development, and promoting development of renewable energy. The City of Clovis Urban Water Management Plan proposes water conservation measures to reduce energy demands and mitigate for climate change. The City of Fresno Metropolitan Water Resources Management Plan (2007) identifies a need for more flood control space to address more frequent flood flows caused by climate change. The City of Fresno also assumes a ten percent decrease in Kings River and San Joaquin River water supplies to Fresno from climate change impacts, although there is no specific basis used to determine this number. Climate change is missing from many older planning documents; however, it is being addressed in most new planning efforts.

17.3 General Impacts from Climate Change

This section discusses potential general impacts from climate change on the Kings Basin. Specific impacts are uncertain, but it is generally agreed that the climate will warm and have a variety of impacts on precipitation, hydrology, and the ecosystem. Some of the potential climate change impacts listed by DWR (Oct. 2008), California Natural Resources Agency (2009) and the U.S. Global Change Research Program (June 2009) include:

Precipitation

- Changes in the seasonality of precipitation
- Increase in frequency and intensity of droughts
- More precipitation and less snowfall, resulting in less water stored in the snowpack
- Increased frequency of rain-on-snow events
- Changes in temperatures and cloud cover that inhibit or prevent cloud seeding
- Lower overall precipitation and increased aridity

Streamflow

- Changes in the timing of spring runoff
- Increased flood risk, creating conflicts between water storage and flood control

Water Demands

- Higher temperatures leading to higher evapotranspiration rates from plants, soils and open water surfaces
- Extended growing seasons resulting in higher evapotranspiration for urban landscape and permanent crops

Water Quality

- Higher water temperatures leading to fish distress and algae growth
- Changes in erosion patterns resulting from changes in runoff and overland flow

Other

- Increased fire risk to rangeland and forests
- Potential for increase in diseases, pest invasions and weed invasions
- Heat waves and crop stress leading to lower crop yield
- Overall geographic changes in distribution of flora and fauna

The California water system is especially vulnerable to climate change due to its dependence on mountain snow accumulation and snowmelt processes. Sierra snow is the largest water reservoir in California and is an important storage mechanism for the Kings Basin. Earlier peak runoff, more intense storms that quickly wash through the system, and lower snowpack levels could all contribute to lower water availability, and increased demand on groundwater.

Predicted changes in precipitation vary, but most predictions include a reduction in overall moisture. For example, Koopman et al. (2010) states that six climate change models described in several California Energy Commission reports showed a drier climate for Central California. On the other hand, California State University at Fresno (2008) states that global climate change models suggest near similar precipitation regimes but with a potential variation of 15-25%. Bashford et al. evaluated two climate change scenarios, including one wet scenario and one dry scenario. The purpose of listing these different predictions is not to throw doubt onto climate change science, but rather show that some uncertainty exists, and water managers should therefore plan for a range of conditions.

Climate change could also have some positive impacts including less frost damage to crops, longer agricultural growing seasons, and less demand for winter heat. However, the Kings Basin water system is designed for a specific climate, and warmer temperatures will generally be detrimental since they will increase water demands and reduce snowpack storage in a water-short area. The risks to the region from no action are clear and include a reduction in available water supply, greater groundwater overdraft, urban water shortages, higher water costs, and lower agricultural output.

17.4 Vulnerability Assessment

A local vulnerability assessment was performed using the 'Vulnerability Assessment Checklist' found in the *Climate Change Handbook for Regional Water Planning* (DWR and EPA, 2011). This checklist, provided below, evaluates vulnerabilities to water demand, water supply, water quality, flooding, ecosystems and habitats, and hydropower from potential climate change.

1. Water Demand

1.a - Are there major industries that require cooling/process water in your planning region?

The region includes a large number of fruit, vegetable, and meat processing plants, but the temperature of the process water is not likely a major factor. The Kings River Conservation District (KRCD) operates a natural gas peaking powerplant (Malaga Peaking Plant) in the area, but cooling water is provided entirely from groundwater. No other major thermal powerplants are located in the region.

1.b - Does water use vary by more than 50% seasonally in parts of your region?

Seasonal water use varies substantially (greater than 50%) in the region. The majority of water is used in the summer for crop irrigation and some landscape irrigation. Water demands are very low in the winter when much of the farmland is idle, most permanent crops are dormant, and effective precipitation provides most of the needed moisture. Approximately one-third of urban water demands occur in the winter with the other two-thirds in the summer.

1.c - Are crops grown in your region climate-sensitive? Would shifts in daily heat patterns, such as how long heat lingers before night-time cooling, be prohibitive for some crops?

The region experiences hot dry summers, and, as a result, most of the crops grown have a relatively good resistance to heat. Changes in heat patterns would probably only impact crop yields if there is a significant increase in temperature. Changes in heat patterns could increase the demand for crop irrigation water. Although freezing temperatures do harm some crops, they are beneficial to some permanent crops that need a certain number of chilling hours below freezing for an effective dormancy. Freezing temperatures also kills some types of pests. Therefore, a reduction in the number of freezing days could negatively impact some crops.

1.d - Do groundwater supplies in your region lack resiliency after drought events?

Groundwater provides an important supplement to surface water in the Kings Basin. Groundwater is used to meet demands not met by surface water, and the demand for groundwater increases during droughts. The region has experienced several severe droughts and the groundwater supply has proven resilient, although there is generally still a steady decline in groundwater levels due to long-term overdraft.

1.e - Are water use curtailment measures effective in your region?

Surface water curtailments include urban water conservation measures and reductions in surface water allocations. Historically, water users have been able to supplement surface

water supplies with groundwater, resulting in few water shortages. However, if groundwater levels continue to decline then groundwater will become less reliable as a backup supply. The area has a hardened demand due to a large number of permanent plantings, so new water conservation programs may have to be implemented in the future if less surface water is available.

1.f - Are some instream flow requirements in your region either currently insufficient to support aquatic life, or occasionally unmet?

Minimum in-stream flow requirements are almost always met. These flows have the highest priority for the surface waters, and flows would be insufficient only in an extreme drought.

2. Water Supply

2.a - Does a portion of the water supply in your region come from snowmelt?

Yes, most of the surface water comes from snowmelt in the Sierra Nevada Mountains. This surface water is used throughout the region. Therefore, the Kings Basin is vulnerable to potential climate change impacts on snow including earlier spring runoffs, less water storage as snowpack, and more frequent rain-on-snow events that could cause flood releases out of reservoirs.

2.b - Does part of your region rely on water diverted from the Delta, imported from the Colorado River, or imported from other climate-sensitive systems outside your region?

A small portion of the Kings Basin, including James Irrigation District, Tranquillity Irrigation Districts, and Fresno Slough Water District, use Delta water as a portion of their water supply. However, as part of their water contracts, these districts can receive San Joaquin River water in place of Delta water if Delta water is not available.

2.c - Does part of your region rely on coastal aquifers? Has salt intrusion been a problem in the past?

No, the region does not rely on coastal aquifers.

2.d - Would your region have difficulty in storing carryover supply surpluses from year to year?

The local reservoirs have some capacity to store carryover water from year to year without encroaching on flood control space. The space to store the water, and ability to keep it in storage, depends on the hydrology. In some years, agencies can carryover water and in other years they cannot. Additional carryover storage capacity would be welcomed by

the local water agencies. The region does have very large sub-surface storage capacity. New groundwater banks are needed to further utilize this underground storage space.

2.e - Has your region faced a drought in the past during which it failed to meet local water demands?

Surface water supplies are reduced during droughts, but groundwater is generally used to meet shortfalls, in addition to some urban water conservation. As a result, almost all water demands have been met in past droughts. If groundwater levels continue to decline, then it may not be a reliable backup supply in the future and some demands may not be met.

2.f - Does your region have invasive species management issues at your facilities, along conveyance structures, or in habitat areas?

Some invasive plant species can clog natural channels and canals if they are not properly managed, so most agencies include this as part of their maintenance activities. Agencies in the area have been alerted to the potential for invasive species such as quagga mussels and how to help prevent their spread.

3. Water Quality

3.a - Are increased wildfires a threat in your region? If so, does your region include reservoirs with fire-susceptible vegetation nearby which could pose a water quality concern from increased erosion?

No reservoirs are located in the Kings Basin itself, but several reservoirs are found in the watersheds that provide surface water to the region. Vegetation surrounds these reservoirs, but it is generally sparse in the immediate vicinity of the larger reservoirs and would not pose a large water quality concern from increased erosion. Some reservoirs at higher elevations have thick forest on the reservoir rim or are located in steeper terrain where post-fire erosion could potentially affect water quality.

3.b - Does part of your region rely on surface water bodies with current or recurrent water quality issues related to eutrophication, such as low dissolved oxygen or algal blooms? Are there other water quality constituents potentially exacerbated by climate change?

Warmer water could cause conditions that lead to eutrophication. However, the surface waters in the region, Kings River and San Joaquin River, are derived from Sierra snowmelt, and are cold and very pure. These waters have few nutrients that support algae growth and it is generally not a problem. However, algae is a problem in the canals that carry Kings River water to treatment facilities and can become a problem during very low flows at the distal end of the rivers.

3.c - Are seasonal low flows decreasing for some waterbodies in your region? If so, are the reduced low flows limiting the waterbodies' assimilative capacity?

No decreases in low flows for the local water bodies have been observed, although no detailed analysis has been performed. Changes in annual low flows from climate change would be difficult to identify since low flows already vary due to natural climate variations and management of reservoir releases.

3.d - Are there beneficial uses designated for some water bodies in your region that cannot always be met due to water quality issues?

Local surface water supplies are able to meet all beneficial uses, which include recreation, hydropower, aquatic habitat, irrigation, and municipal water use. However, operational adjustments are often made to improve water quality for fish. Groundwater quality varies throughout the region and is not suitable for municipal use in some areas. Groundwater quality may degrade further as groundwater levels continue to decline.

3.e Does part of your region currently observe water quality shifts during rain events that impact treatment facility operation?

Yes, even though surface waters in the region generally have excellent water quality, storm activity can cause very high turbidity spikes that can affect the operation of surface water treatment facilities.

4. Sea Level Rise

The Kings Basin is at an average elevation of about 300 feet above mean sea level and is approximately 100 miles from the ocean. Therefore, sea level rise is not a threat to the region.

5. Flooding

5.a - Does critical infrastructure in your region lie within the 200-year floodplain? DWR's best available floodplain maps are available at: http://www.water.ca.gov/floodmgmt/lrafmo/fmb/fes/best_available_maps/.

Most of the floodplains in the Kings Basin are farmland. Some houses, roads, and water supply infrastructure (wells, canals, etc.) are also located in the floodplains. Major flooding would not likely cause serious disruptions to essential emergency-response services.

5.b - Does part of your region lie within the Sacramento-San Joaquin Drainage District?

No.

5.c - Does aging critical flood protection infrastructure exist in your region?

Major flood control facilities include Pine Flat Dam and Kings River levees. In addition, Friant Dam on the San Joaquin River impacts flooding along the San Joaquin River, on the northern boundary of the Kings Basin. These facilities are all considered to be in good condition.

5.d - Have flood control facilities (such as impoundment structures) been insufficient in the past?

Major flood control facilities including dams and levees have been sufficient in past years. Levee breaks along the Kings River would likely not cause serious problems and in most cases would only flood farmland.

5.e - Are wildfires a concern in parts of your region?

Wildfires are not generally a concern in the Kings Basin, but they are a concern in the San Joaquin River and Kings River watersheds which are largely forested. Wildfires can result in severe short-term erosion and water quality degradation of surface waters.

6. Ecosystem and Habitat Vulnerability

6.a - Does your region include inland or coastal aquatic habitats vulnerable to erosion and sedimentation issues?

No.

6.b - Does your region include estuarine habitats which rely on seasonal freshwater flow patterns?

No.

6.c - Do climate-sensitive fauna or flora populations live in your region?

A variety of flora and fauna live in the area and some are likely climate sensitive. Due to urban and agricultural development, some have limited ability to migrate as a means of adapting to climate change.

6.d - Do endangered or threatened species exist in your region? Are changes in species distribution already being observed in parts of your region?

Yes, several threatened and endangered species are found in the area. No noticeable changes in species distribution are known to have occurred since the region was developed.

6.e - Does the region rely on aquatic or water-dependent habitats for recreation or other economic activities?

Recreation is an important part of the local culture on the Kings River, San Joaquin River and in Pine Flat Reservoir. These recreational opportunities also provide a minor benefit to the local economy.

6.f - Are there rivers in your region with quantified environmental flow requirements or known water quality/quantity stressors to aquatic life?

The San Joaquin River and Kings River both have schedules for minimum environmental flows. These flows are the highest priority water uses, and are likely to be met, except possibly in an exceptionally dry year.

6.g - Do estuaries, coastal dunes, wetlands, marshes, or exposed beaches exist in your region? If so, are coastal storms possible/frequent in your region?

No.

6.h - Does your region include one or more of the habitats described in the Endangered Species Coalition's Top 10 habitats vulnerable to climate change (http://www.itsgettinghotoutthere.org/)?

The Kings Basin is not included in the list of top 10 habitats vulnerable to climate change. However, the Kings River watershed is located in the Sierra Nevada Mountains, which is on the list.

6.i - Are there areas of fragmented estuarine, aquatic, or wetland wildlife habitat within your region? Are there movement corridors for species to naturally migrate? Are there infrastructure projects planned that might preclude species movement?

Due to the large amount of urban and agricultural development, prime wildlife habitat is generally fragmented in the valley portion of the Kings Basin. However, wildlife could feasibly travel between prime habitat areas through agricultural land, or along the Kings River corridor and its tributaries. In the foothills, and forested areas east of the basin, large un-fragmented wilderness areas are found. A high-speed rail project is proposed that could further fragment habitats in the Kings Basin.

7. Hydropower

7.a - Is hydropower a source of electricity in your region?

Yes. Hydropower is generated on the Kings River, San Joaquin River, and along the Friant-Kern Canal. The electricity is sold to the local power company and delivered to the electric grid, so it is not necessarily used directly in the Kings Basin but is a valuable resource.

7.b - Are energy needs in your region expected to increase in the future? If so, are there future plans for hydropower generation facilities or conditions for hydropower generation in your region?

Energy demands are likely to increase in the region due to population growth, and to accommodate any climate change. No new major hydropower projects are planned for the area and are probably not likely to be pursued due to permitting difficulties. Some small hydropower projects are being considered along canals or at existing dams to utilize fish release flows. However, the energy generated from these projects would be small.

Conclusions from Vulnerability Assessment

Based on the analysis above the following vulnerabilities were identified for the Kings Basin. These vulnerabilities are listed in their order of priority.

1. **Backup Water Supplies.** The region has a reliable water supply, largely because groundwater is a dependable backup supply during droughts and the dry season. However, the groundwater level is declining, and groundwater demands may increase if climate change reduces precipitation or causes earlier spring runoff that cannot be stored. If groundwater levels decline too much then the groundwater will become a less reliable supply, and groundwater quality may decline. This vulnerability can be measured with several parameters including groundwater overdraft, groundwater level decline, groundwater remaining in storage, and changes in well yields.
2. **Inadequate Water Storage.** Storage facilities in the Kings Basin include Pine Flat reservoir, several smaller reservoirs in the upper Kings River watershed, and groundwater banks in the valley. These facilities have been successful in helping the region regulate seasonal and year-to-year flows; however, there is still demand for more storage. These facilities may be inadequate if warming reduces water storage in the form of snow. Obtaining permits to construct large dams is difficult, and, therefore, storage would have to be developed with numerous groundwater banks and off-channel reservoirs. This vulnerability can be measured by the volume of new storage developed in acre-feet.
3. **Climate Sensitive Crops.** Warmer temperatures could reduce losses for some crops from winter freezes, but other crops depend on some winter freezes to kill pests or ensure an effective dormancy. Higher temperatures could result in lower

yields for these crops. No adaptation measures are available for this impact, other than changing crop types, which is expensive if permanent plantings are impacted. This vulnerability can be measured with the number of chilling hours below freezing and impacts to crop productivity each year.

4. **Flooding.** Flooding is not currently a large problem but increases in high flows could create future problems since it is unlikely that large flood control dams can be constructed. Therefore, proper floodplain zoning and limiting high-value development on floodplains is crucial to preventing future problems. This vulnerability can be measured by the number of essential structures constructed in the 200-year floodplain.

These vulnerabilities will be re-evaluated at least every five years to reflect changes in local cropping, water demands, water supplies, new facilities, and climate change projections.

17.5 Climate Change Models

Climate change models are tools that can help identify a range of possible future climatic conditions. The Kings Basin Water Authority (Authority) did not perform model studies, primarily because several other organizations have modeled the local area. The results from each model differ, likely a result of different assumptions and differences in understanding the earth's processes and feedbacks. Taken as a group, however, climate models present a range of possible future conditions. Two models are described below followed by several general predictions for the State of California and Sierra Nevada mountain range.

Climate Change Sensitivity Study of California Hydrology

In 2001, the Lawrence Berkeley National Laboratory and National Oceanic and Atmospheric Administration published a report entitled '*Climate Change Sensitivity Study of California Hydrology'*. Six headwater basins in California were evaluated including the Kings River Basin. Two climate change projections were used including a warm/wet scenario (HadCM2 run 1) and a cool/dry scenario (PCM run B06.06), based on projections provided by the Third Assessment Report of the Intergovernmental Panel on Climate Change. The 'cool/dry' scenario still includes increasing temperatures, but at a slower rate than the 'warm/wet' scenario. The conditions described by these global models were used to assess local conditions in specific areas of California.

The study provided estimated changes in temperature and precipitation for the two scenarios during different time periods. These impacts are ultimately reflected in changes to streamflows, which are illustrated in **Figure 17-2**. The streamflow ratios represent the ratio of projected streamflow to historical conditions (historical conditions have a ratio of 1.0).

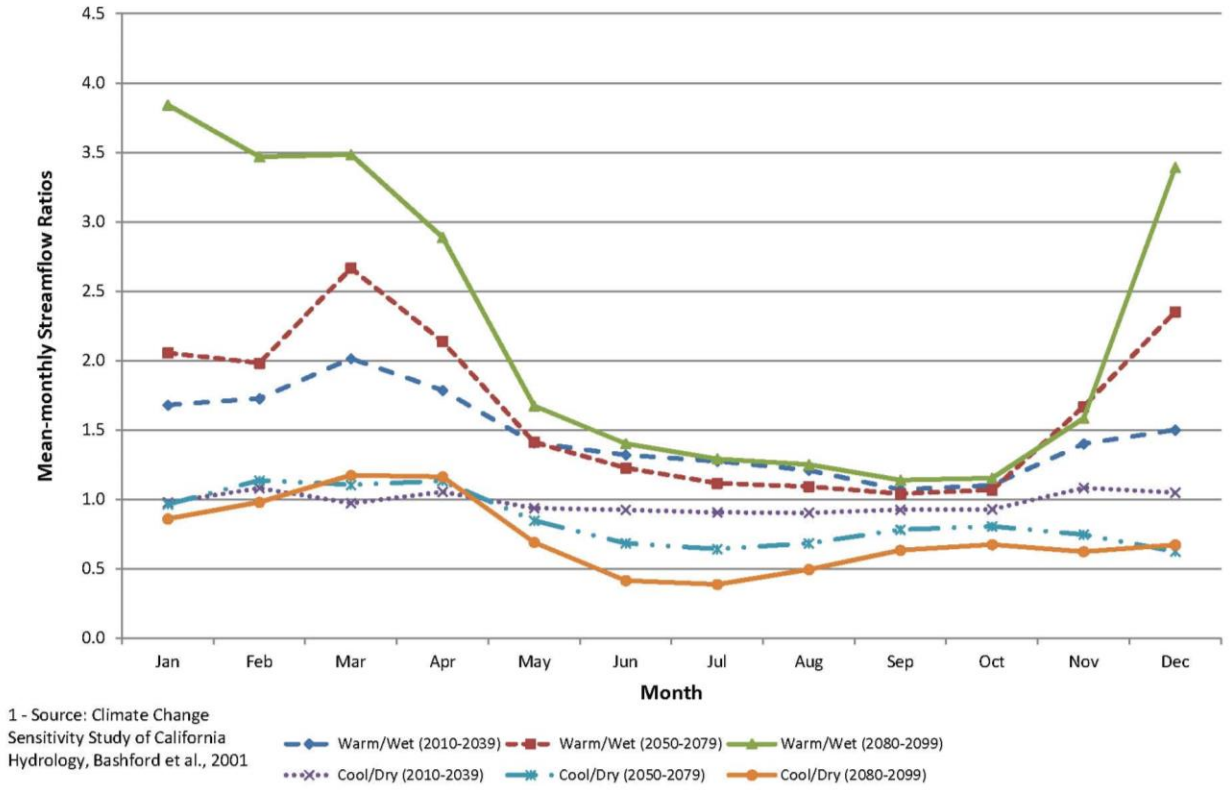

Figure 17-2: Estimated Impacts to Kings River Flows
(Warm/Wet and Cool/Dry Climate Change Scenarios)

Figure 17-2 shows two vastly different scenarios and illustrates both the uncertainty in climate change predictions and the importance of being prepared for a range of impacts.

The warm/wet scenario would provide additional water, which would be welcome in the water-short Kings Basin. However, some of this moisture would be lost to higher evaporation and transpiration, and some would leave the basin as flood flows. This scenario could also present serious flooding problems throughout the Kings Basin, especially along the Kings River.

The cool/dry scenario would result in less overall moisture. Streamflows would be higher in the late winter and early spring due to earlier snowmelts. Late spring and summer flows would be lower, which could have serious water supply impacts.

The report also lists seven previous studies that suggested Sierra Nevada streams are likely to peak earlier in the season under global warming. In addition, a key finding was that basin elevation has the greatest influence on streamflow sensitivity to climate change. The Kings Basin watershed is at a high elevation compared to some of the other basins modeled and was less sensitive to rising temperatures.

Future Climate Conditions in Fresno County and Surrounding Counties

In 2010, the National Center for Conservation Science and Policy (NCCSP), prepared a report entitled '*Future Climate Conditions in Fresno County and Surrounding Counties'*. The report predicted climate change impacts in Fresno, Madera, Kings and Tulare Counties. The entirety of the Kings Basin is included in the study area.

The report is based on climate change model outputs provided by the USDA Forest Service Pacific Northwest Research Station and mapped by the NCCSP. Three global climate models were selected that represent a range of projections for temperature and other climate variables. These three models are Hadley (HADCM from the UK), MIROC (from Japan), and CSIRO (from Australia). Model outputs were converted to local scales using data on historic precipitation and temperature patterns. NCCSP mapped climate variables for a historical period (1960-1990) and for two future periods (2035-2045 and 2075-2085). Results were divided into a lower region (<1,000 feet elevation) and an upper region (> 1,000 ft elevation). The predicted changes in precipitation and temperature are summarized in **Table 17-1** and **Table 17-2**. The report did not provide predicted changes in streamflow.

Table 17-1: Projected Changes in Precipitation

Time Period	Average Precipitation (% change from historic)			
	Lower Region		Upper Region	
Historic	9.4 in	-	29.9 in.	-
2035-2045	6.9 – 10.6 in.	-27% to +13%	21.7 – 33.6 in.	-28% to 12%
2075-2085	6.8 – 8.8 in.	-28% to -7%	20.5 – 28.2 in.	-32% to -6%

Note: USDA Forest Service Model

Projections for future precipitation varied among the three models, but all three agreed on drier conditions, on average, by late century, especially in the spring.

Table 17-2: Projected Increased in Temperature

Time Period	Upper Region (F°)	Lower Region (F°)
Historic	46.4	62.3
2035-2045	+2.5 – 4.8	+2.3 – 4.3
2075-2085	+5.2 – 8.9	+4.7 – 8.2

Note: USDA Forest Service Model

General Predictions for California and the Sierra Nevada Mountain Range

Several publications provide general statements on predicted climate change in California and the Sierra Nevada range. These general statements are not specific to the Kings Basin and are generally considered less reliable than local modeling results. However, they are useful for discussion and comparison purposes, and are listed in **Table 17-3**.

Table 17-3: General Climate Change Predictions

Source	Prediction
Climate Change Adaptation Strategies for California's Water (DWR, 2008)	Water managers should use a drought component that assumes, until more accurate information is available, a 20 percent increase in the frequency and duration of future dry conditions.
	DWR projects that Sierra snowpack will experience a 25 to 40 percent reduction from its historic average by 2050.
Sierra Climate Change Toolkit, 2nd Edition (Sierra Nevada Alliance, 2007)	In most cases, total annual streamflow into major Sierra Nevada reservoirs is projected to drop about 10 to 20 percent before mid-century and 25 to 30 percent before the end of the century.
The Ahwannee Principles for Climate Change (Local Government Commission, 2009)	The State's largest reservoir (snowpack) is predicted to lessen by one third over the next 50 years and to half its historic size by the end of the century.

17.6 Adaptation Measures

Climate change adaptation is a response that seeks to reduce the severity of climate change impacts to human and natural systems. The adaptation measures identified below do not address a specific quantified impact, but rather focus on a range of potential impacts. Since climate change predictions will never be perfect, flexibility and diversity in adaptation measures is fundamental. The adaptation measures will also help the region to improve resiliency, which is defined as the ability to return to original conditions after a disturbance or impact.

The DWR defines 'no-regret' strategies as actions that provide measurable benefits today while also reducing vulnerability to climate change (DWR, 2011). In other words, they are strategies that provide benefits with or without climate change. For instance, constructing a water bank would provide needed water supply benefits in the present, but could mitigate climate change impacts through floodwater capture, increasing water storage, and enhancing wetland habitat. The Water Education Foundation (2010) believes that planning for climatic uncertainty will also benefit planning for regulatory, environmental, economic, and social uncertainty.

The IRWMP Update Workgroup concluded that no-regret strategies should comprise the majority of adaptation measures. Consequently, the threat of climate change further justifies the need for many water management strategies already being used in the

region. Furthermore, climate change adaptation is not in conflict with current Goals and Objectives of the region.

Most of the resource management strategies described in Section 6 would assist with climate change adaptation. However, the following strategies were deemed the most practical and effective for climate change adaptation in the Kings Basin:

- Improve urban and agricultural water efficiency
- Increase use of recycled water (where energy efficient)
- Revise land use planning policies to encourage conservation (e.g. low impact development or water efficiency standards)
- Develop groundwater recharge and banking projects
- Develop water storage projects inside and outside of the Kings Basin
- Increase ability to capture floodwater both for flood control and water supply
- Restore mountain meadows, wetlands, and riparian areas to regulate flows resulting in more summer runoff
- Change crop types to accommodate climate change

The overall theme with these strategies is to expand the extreme conditions (drought and floods) that the region can accommodate. Eliminating or reducing groundwater overdraft is considered the primary strategy for addressing water supply impacts from climate change.

17.7 Climate Change Monitoring

Climate change monitoring includes two components: 1) monitoring hydrologic and meteorologic parameters for climate change; and 2) monitoring climate change literature, legislation and modeling results.

The Kings Basin already includes a robust network for monitoring the hydrology, meteorology, water demands, water use, crop yields and wildlife. No immediate improvements are needed to monitor for climate change. The monitoring programs are periodically evaluated and upgraded, and the need for improvements to evaluate climate change will also be periodically evaluated.

Water projects were designed and are operated on the assumption that future hydrology will mimic past hydrology. Climate change will likely change future hydrology. However, the specific changes to the hydrology are uncertain, and some scientists are still undecided on whether the region will have a wetter or drier climate. Consequently, future projects will continue to be designed based on past hydrology until more definitive predictions are available. However, the potential change in hydrology is the driving force behind adaptation measures which will be pursued by the Authority.

The science of climate change, and the tools to mitigate and adapt to climate change, are still evolving. As a result, every five years as part of the California Water Plan Update

process, DWR will provide revised estimates of changes to sea levels, droughts, and flooding that can be expected over the following 25 years. The Authority will also stay apprised of new studies, reports, literature, legislation, and climate change model runs that are pertinent to the area. When needed this literature will be shared with the Authority members and interested parties and incorporated into the IRWMP updates.

17.8 Mitigation of Greenhouse Gas Emissions

Mitigation of climate change can be achieved by selecting and promoting projects that help to reduce greenhouse gas emissions (GHG) emissions. While the Authority is not responsible for air quality management, and they can only have a small impact on global emissions, it is sensible to consider emissions in project selection in view of the negative impacts climate change may have on water resources. The Authority is also dedicated to helping the State meet GHG emission reduction goals. These goals, prescribed in the California Global Warming Solutions Act of 2006 (AB 32), include reaching 2000 emission levels by 2010, 1990 levels by 2020, and 80% below 1990 levels by 2050.

All of the resource management strategies described in Chapter 6 can assist with climate change mitigation through reduction in energy demand, ecosystem enhancement, or carbon sequestration. For instance, water conservation can reduce energy demands to pump, convey, and treat water supplies. Another example is riparian area restoration, which can sequester carbon and create habitat for species impacted by climate change.

Projects are primarily ranked based on their water supply benefits, but GHG emissions and climate change adaptation were added as secondary considerations. Specifically, the following questions were added to the Project Review Process form:

1. Will this project result in reduced greenhouse gas emissions? If yes, explain how and quantify.
2. Will this project increase greenhouse gas emissions? If yes, explain how and quantify.
3. Will this project contribute to adaptation strategies to respond to climate change impacts?

Beginning July 1, 2012, GHG emissions for California Environmental Quality Act (CEQA) studies are required to be calculated using the California Emissions Estimator Model (CalEEMod). CalEEMod quantifies potential criteria pollutant and GHG emissions from construction and operations for a variety of projects. The Authority will also require that this model be used on projects considered for funding.

17.9 Climate Change in other IRWMP Sections

Climate change is discussed in several other IRWMP sections including:

- **Chapter 5 – Goals and Objectives.** This chapter includes general goals related to climate change adaptation and mitigation.
- **Chapter 6 - Resource Management Strategies –** This chapter discusses the impacts of climate change on the efficacy of different strategies, and the ability of strategies to help adapt to climate change.
- **Chapter 7 - Project Review Process –** The project review process includes new questions related to GHG emissions (Section 17.8)
- **Chapter 12 - Relation to Local Water Planning –** This chapter summarizes the climate change adaptation and mitigation strategies from local water plans and evaluates their consistency with the goals of this IRWMP.

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